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A. McL. Marshall

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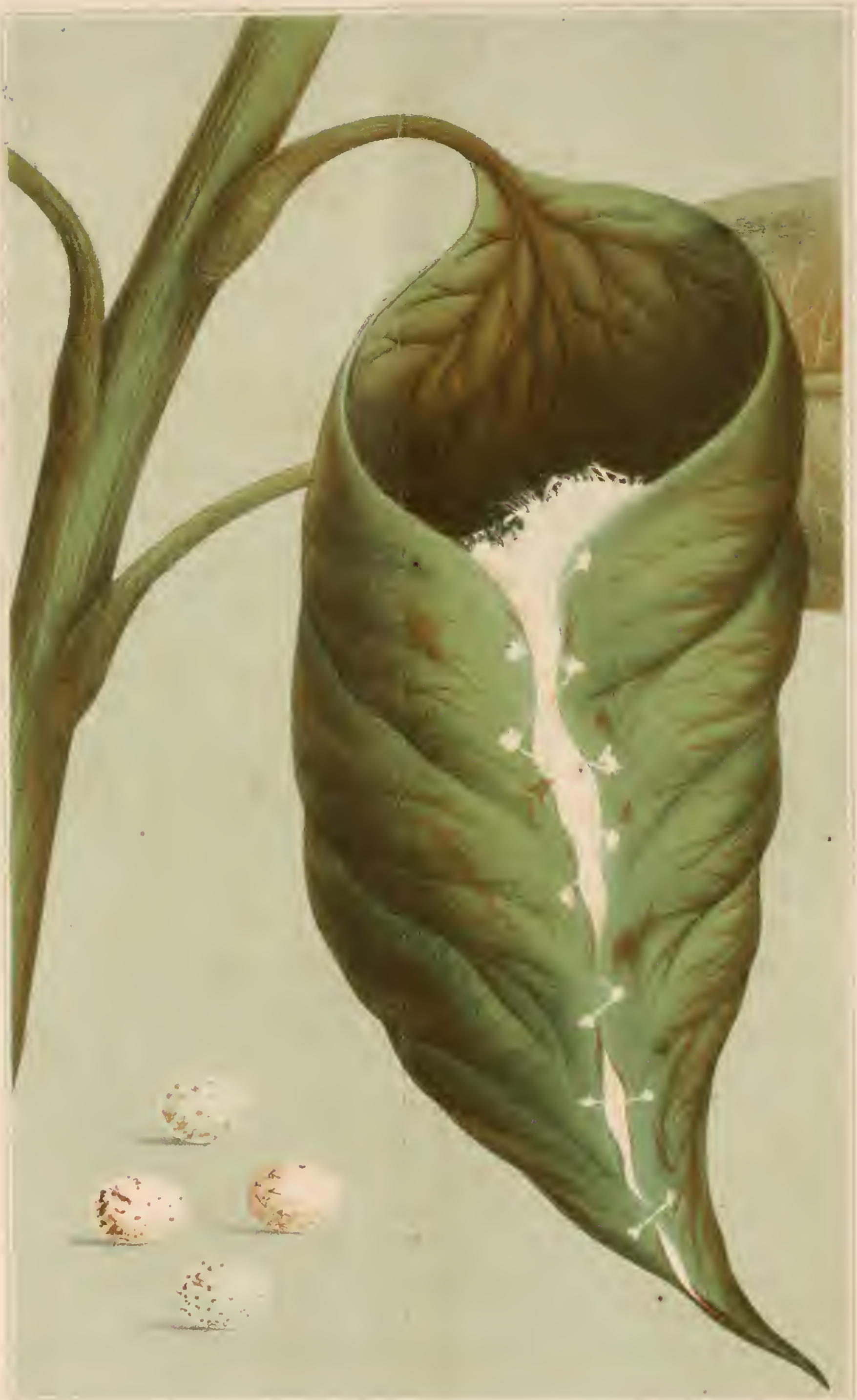

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530. ORTHOTOMUS SUTORIUS. Forst.
The Indian Tailor Bird.

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NESTING IN WESTERN INDIA.

By Lieut. H. E. Barnes.

(*Continued from page 255, Vol. IV.*)

475.—THE MAGPIE ROBIN.

Copsychus saularis, Lin.

The Magpie Robin is another species that appears to be rare, if not altogether absent from Sind; it occurs sparingly in Guzerat, becomes much more common in the Deccan, and is most abundant in Ratnagiri and the Southern parts of the district generally.

As a rule they are permanent residents where they occur, but I never succeeded in finding a nest in the neighbourhood of Deesa, but Mr. Littledale has found several at and near Baroda. In all the other parts of Western India it is a common breeder.

The breeding season lasts from early in May to about the middle of July, but nests may be found both earlier and later than this.

The nests are generally placed in holes in trees, occasionally in holes in walls, &c., and are composed of grass roots, vegetable fibres, moss, &c. It is a shallow saucer in shape, often a mere pad, and the eggs, five in number, sometimes only four, much more rarely six, are as a rule oval in shape and pale greenish-white in colour, but are subject to much variation both in shape and colour; they are streaked, spotted, speckled, and blotched with various shades of brownish-red. One clutch I have is a pale sea-green, sparingly but beautifully blotched with reddish-brown, and having smudges of faint inky purple at the larger end. In another clutch the ground-colour is a bluish-green. The markings are usually much more numerous at the larger end, where they often form an imperfect zone or cap. Often the markings are so thick as to leave little of the ground colour visible.

They vary much in size, but the average is 0·87 inches in length by rather more than 0·66 in breadth.

Mr. Davidson tells me that, according to his experience, this bird seems to breed only in the West part of the Presidency; thus, he has taken its nest in Satara and the western talukas of Nassick, never in Khandeish, Sholapur, or the eastern Nassick talukas. In Kanara it swarms, breeding from the middle of March to the rains.

After the eggs are hatched, the birds are very quarrelsome, boldly attacking any other bird or animal that approaches the nest.

The young are easily reared by placing them in a cage accessible to the parent birds, who will attend and feed them in the same way that the Golden Oriole does. They have a sweet song, which is heard to most advantage in the early morning during the breeding season.

Poona, April to June.		*H. E. Barnes.*
Bombay, 18th March to June.		,,
Satara,	*Middle of March to June.*	*J. Davidson, C.S.*
Western Nassick,	,, ,,	,,
Kanara,	,, ,,	,,
Baroda,	,, ,,	*H. Littledale, B.A.*

476.—THE SHAMA.

Cercotrichas macrura, Gm.

The Shama only occurs in the southern portion of the Presidency, where it is a permanent resident, but I can find no record of a nest having actually been taken there.

Mr. Davidson notes—"Common though this bird is in the above ghat portion of Kanara, from March to May, and probably all the year, I not only never got a nest (the birds were then breeding), but I never managed to shoot a hen-bird."

According to Mr. Hume's *Nests and Eggs of Indian Birds*, page 306, they breed during April and May in holes in trees, making a large nest of leaves and twigs, lined with fine twigs, and laying three eggs moderately broad oval in shape, a good deal pointed at one end, and exhibiting a slight pyriform tendency. The shell, which has a slight gloss, is fine and compact. The ground colour is dull greenish-stone (but very little of it is visible), and it is everywhere very densely freckled, in some rather streakily, with a rich, almost raw, sienna-brown, in amongst which dull purplish markings are, when the egg is closely looked into, found to be thickly mingled. The combined effect, when looked into at a little distance, is of a dense ruddy purplish-brown mottling.

The eggs vary from 0·87 to 0·9 inches in length, and from 0·6 to 0·62 in breadth. They are small for the size of the bird. As Mr. Hume remarks, they remind one of some of the Lark's eggs.

479.—THE INDIAN BLACK ROBIN.

Thamnobia fulicata, Lin.

It is considered doubtful by many whether the Indian Black Robin is distinct from the Northern Indian Robin (*Thamnobia cambaiensis, Lath.*) It is hard at times to distinguish between them: typical specimens are of course widely different, but many intermediate forms occur linking them together, but so long as the Black and Painted Partridges, the Dark Ashy, and Stewards' Wren Warblers, and many others are considered entitled to specific distinction, these also must be retained. I cannot attempt to define the limits of each, but generally speaking, typical *fulicata* occurs in the south and *cambaiensis* in the north, but it is difficult, in fact impossible, to draw any hard and fast line between them.

They breed from April to the middle of July. The nest is a mere pad composed of grass stems and roots, vegetable fibres, cotton, moss, &c., lined with hair and feathers, and is placed in a hole in a wall or bank, on ledges of rock, and occasionally between the roots of trees; very rarely is the nest placed in a bush; in this latter case it is much more neatly and compactly made, and is cup-shaped.

The eggs, usually three in number, sometimes four, more rarely only two, are moderately elongated ovals in shape, pinched in a little at the smaller end, and are greenish-white in colour, thickly speckled, spotted, streaked, and freckled with reddish and yellowish-brown. These markings usually form a more or less irregular cap at the larger end.

They average 0·72 inches in length by rather more than 0·55 in breadth.

480.—THE NORTHERN INDIAN ROBIN.

Thamnobia cambaiensis, Lath.

The Northern Indian Robin breeds in exactly the same way as the Indian Black Robin and about the same time.

The eggs, three in number, are moderately elongated ovals in shape and pointed at one end; they vary very much both in the ground colour and character of the markings, but the usual type is greenish-white closely freckled, or stippled with reddish-and yellowish-brown. Others are more or less boldly streaked and spotted with bright red-brown, with an occasional underlying spot of pale inky-purple. Creamy-, bluish-, and pale brownish-white varieties are not uncommon. One clutch I have is most beautiful, being of a pale sea-green colour, with a few large blotches of faint pinkish-purple and clayey-brown. Had I not shot the bird from the nest, I should have been at a loss to identify the eggs. They measure about 0·79 inches in length by about 0·59 in breadth.

481.—THE BLACK STONE-CHAT.

Pratincola caprata, Lin.

The Black Stone-Chat or White-winged Black Robin is a common permanent resident throughout the district; it however almost disappears from some parts during the breeding season, which extends from April to June.

They build flat saucer-shaped nests, composed of grass, fine roots, vegetable fibres, &c. It is, as a rule, placed in a hole in a bank, or well; occasionally, however, they build in bushes, but even here the nest actually touches the ground. I once found a nest in a small heap of rotten grass.

They are much more common on the hills than on the plains, more especially during the breeding season.

The eggs, four in number, often five, are moderately broad ovals in shape and pointed at one end; the ground colour is pale bluish-green, freckled, speckled and streaked with brownish-red. The markings are much more dense at the larger end, where they often form a confluent cap. They vary much in size, but the average is 0·67 inches in length by about 0·55 in breadth.

Khandalla, April to June.	*H. E. Barnes.*
Satara Ghats, April.	*J. Davidson, C.S.*
Nassick Ghats, March to May.	,,
Kanara, May.	,,
Eastern Narra, Sind, April to August.	*S. B. Doig.*

489.—THE PIED STONE-CHAT.

Saxicola picata, Blyth.

At present the Pied Stone-Chat can only be said to be a cold weather visitant; common in Sind and the north generally, becoming more and more scarce in the central portion of the Presidency, and being altogether absent from the south.

I found it to be a common breeder at Chaman, on the Khoja Amran range of hills in Southern Afghanistan; I have reason to believe that it breeds also in the Bolan Pass, and would not be surprised to learn that eggs had been taken in Northern Sind.

They breed in holes in trees in March, making a pad-shaped nest of grass, composed of dry grass and roots, lined with hair and feathers.

The eggs, four in number, are elongated ovals in shape, pinched in a little at one end; the ground colour is a delicate greenish-blue, obsoletely speckled with rusty-brown or pale brownish-red at the larger end, where the markings form an irregular zone. A few specks of the same colour are scattered over the rest of the surface of the egg. The average of twelve eggs measured is 0·81 inches in length by 0·56 in breadth.

Chaman, South Afghanistan, March.	*H. E. Barnes.*

492*ter*.—THE GREY-BACKED WARBLER.

Ædon familiaris, Mene.

This is a very uncommon species, and only occurs as an exceptionally rare winter visitor to Sind and Northern Guzerat; further west, in Beloochistan and Persia, it becomes more common, breeding freely at Bushire.

Mr. J. W. N. Cumming, to whose kindness I am indebted for a clutch of eggs of this species, has most obligingly furnished me with the following note, which is at present the extent of our information regarding the breeding of this somewhat rare bird :—

"Once only have I come across the nest of the Grey-backed Warbler, and that on the 14th April 1884, in the telegraph garden at Bushire. It was placed inside (a few inches from the top) of one of a number of old hollow telegraph posts, standing about three feet out of the ground, and forming supports to the wire fencing surrounding the garden. The eggs, four in number, were entirely covered with minute yellowish-brown spots and very pale purple blotches, hiding almost completely the white shell, and are similar in shape to, though a good deal larger than, those of *Thamnobia cambaiensis*.

"The nest was cup-shaped, and the materials consisted of fine grass, well lined with hair and fibres. In the evening of the same day, the female was caught seated in the nest, about to lay its fifth and last egg, for, on dissecting the ovary, after the removal of the skin, I found an entire and perfect egg, which would in all probability have been laid that night.

"My brother, also, when at Fao, came across a number of nests of this species, chiefly in holes in walls and on date trees, in the hollows at the bases of the leaves."

The eggs are very similar in shape and colour to the thickly speckled type of egg so commonly met with amongst those of *Thamnobia cambaiensis et fulicata*, but are rather larger, those in my collection measuring 0·82 inches in length by rather more than 0·62 in breadth.

Strictly speaking, an account of the nesting of this bird ought not to appear in this paper, as it has never been found breeding in this Presidency, but I have been assured that since the present arrangements for the supply of water at Karachi, this and several other rare birds have become more common, and it is not unlikely that sooner or later a nest will be found.

494.—THE BROWN ROCK-CHAT.

Cercomela fusca, Blyth.

The Brown Rock-Chat is very common at Mount Aboo, and in the vicinity of Neemuch, Rajpootana.

It does not occur in Sind, and is absent from the south. Mr. Davidson did not meet with it in Khandesh or in Nassick.

It is a permanent resident where found, breeding twice a year, during March and April, and again in June and July.

It is a bold and familiar bird, and is the Shama* of Mr. Phillips, (*Nests and Eggs of Indian Birds*) ; they frequent old buildings, forts, outhouses, and such like places, in holes and crevices in the walls of which they build their nests.

The bird has a peculiar habit of heaping up a pile of small stones, pebbles and broken tiles, leaving a depression in which it places its nest. I had the curiosity to weigh one of these heaps, which was composed entirely of broken tiles, and found it to weigh 7 lbs. 2 oz. ; this was, however, much larger than usual. The nest itself is a thick, saucer-shaped pad, composed of fine grass, lined with wool and hair. The eggs, three in number, occasionally four, are moderately broad ovals in shape, pointed at one end, and are pale blue in colour, faintly speckled with pale reddish-brown. Sometimes the markings are bolder and brighter, and form a well-defined ring round the larger end. They measure 0·82 inches in length by about 0·62 in breadth.

Mount Aboo,	*March to April and June to July.*	*H. E. Barnes.*
Neemuch,	,, ,, ,, ,, ,,	,,
Saugor,	,, ,, ,, ,, ,,	,,

515.—THE LARGE REED WARBLER.

Acrocephalus stentorius, Hemp and Ehr.

Mr. Doig appears to be the only oologist who has succeeded in obtaining eggs of the Large Reed Warbler within our limits or even in India, although the bird breeds abundantly in Cashmere. He says (*Stray Feathers,* Vol. ix., p. 279) :—" On the 4th August, while my man was poling along in a canoe, in a large swamp, on the look out for eggs, he passed a small bunch of reeds, and in them spotted a nest with a bird on it.

" The nest contained three beautiful fresh eggs. A few days later I joined him, and on asking about these eggs, he described the bird, and said he had found several other nests of the same species, but all of them contained young ones, nearly fledged. I made him show me some of these nests, all of which were situated in clumps of reeds in the middle of the swamp, and in these same reeds I found and shot the young one, which though fledged was unable to fly. This I sent with one of the eggs to Mr. Hume, who has identified them as belonging to this species.

---

* The native name of this bird throughout the Central Provinces is " *Shama* " ; the real Shama, *Cercotrichas macrura,* does not occur there.—H. E. B.

"The nests were composed of frayed pieces of reed-grass and fine sedge, the latter being principally towards the inside, thus forming a kind of lining. The nests were loosely put together and were about three inches inner diameter, one and a quarter inches deep, the outer diameter being six inches; they were situated about a foot over the water, in the tops of reeds growing in the water."

Mr. Hume, in *Nests and Eggs of Indian Birds*, page 327, writing of eggs received from Cashmere, described them as follows:—"The eggs of this species, as might have been expected, greatly resemble those of *A. turdoides*. In shape they are moderately elongated ovals, in some cases almost absolutely perfect, but generally slightly compressed towards one end. The shell, though fine, is entirely devoid of gloss.

"The ground colour varies much, but the two commonest types are pale green or greenish-white, and a pale, somewhat creamy, stone colour. Occasionally the ground colour has a bluish tinge.

"The markings vary even more than the ground colour. In one type the ground is everywhere minutely, but not densely, stippled with minute specks, too minute for one to be able to say of what colour; over this are pretty thickly scattered fairly bold and well marked spots and blotches of greyish-black, inky-purple, olive-brown, and reddish-umber-brown; here and there pale inky clouds underlay the most distinct markings.

"In other eggs the stippling is altogether wanting, and the markings are smaller and less well defined.

"In some eggs, one or more of the colours predominate greatly, and in some several are almost entirely wanting.

"In most eggs the markings are densest towards the large end, where they sometimes form more or less of a mottled, irregular, ill-defined cup.

"In length the eggs vary from 0·8 to 0·97, and in breadth from

0·58 to 0·63; but the average of the only nine eggs I measured was 0·89 nearly, by rather more than 0·61."

Eastern Narra, Sind, August, *S. B. Doig.*

530.—THE INDIAN TAILOR BIRD.

Sutoria sutoria, Forst.

The Tailor Bird is a common permanent resident throughout Western India, except in Ratnagiri, where it is stated by Mr. Vidal to be only sparingly distributed.

They breed from June to the end of August. To one unacquainted with their habits, their nests are hard to find, although during the time the hen is sitting on the eggs, the cock (who may be distinguished by his elongated central tail feathers), keeps up an incessant but pleasant twittering, on a neighbouring bough, and though one knows that a nest is somewhere close at hand, it requires a careful and persevering search to find it.

If the bird chooses a leaf sufficiently large, it sews the opposite edges together with cotton fibre or even spider's web, and in the cavity thus formed, it makes a soft nest of cotton, with just a few hairs to keep it in shape.

When two or more leaves are incorporated in the nest, it is not so neatly made, and is much easier to find.

They lay three or four eggs (twice I have found five eggs, and once seven), of an elongated oval shape, pointed at one end: they average 0·64 inches in length by rather more than 0·45 inches in breadth. They are of two types, in one the ground colour is white, suffused with a reddish tinge when the eggs are fresh and unblown, more or less spotted, speckled and blotched with reddish brown; in the other the ground colour is pale greenish, also spotted and speckled with brownish-red. The markings in both types are generally more numerous at the larger end, where they often form an imperfect zone; usually the markings are bright and boldly defined, but occasionally they are dingy.

532.—THE YELLOW-BELLIED WREN WARBLER.

Prinia flaviventris, Deless.

Within our limits the Yellow-bellied Warbler has only been recorded from Sind, where it is a permanent resident, breeding apparently three times a year, *viz.* March, June and September. I have never seen a nest, but they are well described by Mr. Hume in his "*Nests and Eggs of Indian Birds.*" He says:—"The nest is of an oval shape, very obtuse at both ends, measuring externally four inches in length and about two and three-quarters in diameter. The aperture, which is near the top of the nest, is oval, and measures about an inch by one and a half inches. The nest is fixed against the side of two or three leafy twigs, to which it is bound tightly in one or two places with grass and vegetable fibres, and two or three leafy lateral twigs are incorporated into the sides of the nest, so that when fresh it must have been entirely hidden by leaves.

"The nest was in an upright position, the major axis perpendicular to the horizon. It is a very thin, firm, close, basket-work of fine grass, flower stalks, and vegetable fibres, and has no lining, though the interior surface is more closely woven and of still finer materials than the outside. The cavity is nearly two and one half inches in diameter." This is a description of a nest presented to Mr. Hume by Mr. J. C. Parker, who took it from the swampy banks of the canals that intersect the salt water lake, Calcutta. The eggs, four in number, are broad regular ovals, of a nearly uniform mahogany-red, measuring 0·56 inches in length by 0·45 in breadth.

They are highly glossy.

A nest taken by Mr. Doig was lined with horse hair and fine grasses.

Eastern Narra, Sind, March, June and September. *S. B. Doig.*

534.—THE ASHY WREN WARBLER.

Prinia socialis, Sykes.

Typical specimens of the Ashy Wren Warblers (*Prinia socialis*) and Stewart's Wren Warbler (*Prinia stewarti*) differ only in size, and many birds may with equal justice be assigned to either species. I am personally of opinion that there is only one species. Captain (now Colonel) Butler in his *Birds of Guzerat*, identified all his birds as *socialis*; the Deccan birds are also considered to be *socialis*. Mr. Davidson considers the birds he found in Western Khandeish to be *stewarti* (these birds were sent to Mr. Hume, and he also identified them as *stewarti*); in Neemuch an intermediate type prevails.

They are permanent residents, breeding from the commencement to the end of the rains.

The nests differ greatly, some of them are placed between two or more leaves, sewn carefully together, tailor-bird like, but as a rule not so neatly, a good deal of fine grass being used in addition to the cotton. Occasionally the nest is placed in a tuft of grass, and is then composed of tightly woven grass, and is dome-shaped, having the aperture near the top. Others are composed of vegetable down affixed to leafy twigs, much in the same way as those of the Yellow-bellied Wren Warbler (*Prinia flaviventris*).

The eggs, four or five in number, are oval in shape, and are of a brilliantly glossy-brick or mahogany-red colour, darker as a rule at one end, where it forms an indistinct cloudy cap.

They average about 0·64 inches in length by 0·47 in breadth.

535.—STEWART'S WREN WARBLER.

Prinia stewarti, Blyth.

The eggs of Stewart's Wren Warbler average 0·62 inches in length by about 0·46 in breadth, or rather smaller than those of the Ashy Wren Warbler; in all other respects they are identical.

538.—THE MALABAR WREN WARBLER.

Prinia hodgsoni, Blyth.

It is now admitted by most ornithologists, that the Malabar and Franklin's Wren Warblers (*Prinia gracilis*) are one and the same species, *hodgsoni* being nothing more than *gracilis* in breeding plumage.

The Malabar Wren Warbler is more or less common in suitable places in Western India, with the exception of Sind and perhaps Cutch, where it is not known to occur.

Mr. Davidson, who has had excellent opportunities of observing this bird, says *in epis*: "As far as I know I have never seen this bird in Sholapur, Satara, Poona or Kanara, while it is common in Khandeish and found in Nassick; I therefore suspect it is a Northern form in the peninsula."

They are permanent residents, breeding during the rainy season, making a somewhat similar nest to that of the Tailor Bird, but much smaller it is composed of very fine grass, placed between two or more leaves, carefully sewn together, with cobwebs, cotton, or wool, and is almost completely hidden by leaves.

The eggs, four in number, are of an oval shape, and are of four distinct types, *viz.*:—

a. Pure unspotted glossy white.
b. White, speckled and freckled with reddish-brown.
c. Pale unspotted greenish-blue.
d. Pale blue, spotted and freckled with reddish-brown.

All the eggs in one nest are of one type. Some of the spotted eggs have the markings thickest at one end, where they often form an imperfect cap or zone.

They measure 0·57 inches in length by about 0·42 in breadth.

Baroda, July to September. *H. Littledale, B.A.*
Western Khandeish, July to October. *J Davidson, C.S.*

539.—THE RUFOUS GRASS WARBLER.

Cisticola cursitans, Frankl.

With the exception of the higher ranges of hills where it is scarce, and in the desert tracks where it is altogether absent, the Rufous Grass Warbler is a more or less common permanent resident, breeding during the rains, making a long purse-like nest, composed of silky, white, vegetable down, which is placed in the centre of a clump of grass, at a short distance only above the ground.

The blades of grass around the nest are so firmly interwoven with it, that it cannot be removed intact. It is rather larger at the bottom than at the top, and the tacking together of the blades of grass is continued higher on one side than the other, a small entrance being left on the opposite side, between the untacked stems; the inside is well lined or felted with soft vegetable down.

The eggs, four or five in number, are broadish ovals in shape, narrowing somewhat at one end; they average 0·58 inches in length by 0·46 in breadth.

In colour they are white, or faint greenish-white suffused with a pinkish tint when fresh and unblown, and are thickly speckled with pale reddish-brown. These specks are much more numerous at the larger end, where they often form an imperfect zone or irregular cap.

Hyderabad, Sind,	*July.*	*H. E. Barnes.*
Deesa,	*July to September.*	*Do.*
Khandeish,	*September.*	*J. Davidson, C.S.*
Baroda,	*June to August.*	*H. Littledale, B.A.*

543.—THE COMMON WREN WARBLER.

Drymœca inornata, Sykes.

The Warblers belonging to the *Drymœca* group, seem to be very much mixed, the different species being very hard to discriminate. Personally I have only met two in the flesh that I could feel sure about; these are the present species and *Drymœca sylvatica.*

I strongly suspect that specimens of this last often do duty for *rufescens* and *insignis.*

The Common or Earth-brown Wren Warbler is a permanent resident throughout Western India, breeding from the middle of July to the end of September.

It usually constructs a rather pretty nest, composed of fine strips torn from blades of green grass, which are plaited together like those of the Baya, but the strips are finer and the nest is altogether neater. It is usually fastened to the thorny twigs of acacia bushes, at no great height from the ground, and the shape depends largely on the position of these twigs.

According to my experience, the nests are never lined, but Mr. Davidson writes that he has taken nests lined with fine fluff, with similar eggs, apparently belonging to this bird, but he has never actually shot the parents.

Another type of nest is composed of similar material, but is much coarser and is more loosely woven.

Nests of this latter description are built in clumps of sarpat, guinea, or other coarse-growing grass, or even in standing corn; they are purse-shaped with the aperture on one side, the opposite side being prolonged and projecting over so as to form a canopy.

In some cases the nests are sewn by shreds of fine grass, to the under side of a large leaf of the shrub that grows so commonly in grass jungle; this leaf forms a canopy over it, and effectually protects it from rain; the nest, which is bag-shaped, is held in position by long stays of fine grass or fibres sewn and fastened to the nearest leaves and stalks.

The eggs, four or five in number (usually five), are moderately long ovals in shape, and are of a glossy pale greenish-blue colour, boldly spotted and blotched with chocolate and reddish-brown, and having a delicate tracery of interlaced hair-like lines at the larger end, but occasionally these lines are absent; the small end is comparatively unspotted.

The ground colour is subject to variation, eggs having been taken of a dull olive tint, and still more rarely of a clear reddish-white.

They average 0·61 inches in length by about 0·45 in breadth.

544 *bis.*—THE GREAT RUFOUS WREN WARBLER.

Drymœca rufuscens, Hume.

Captain (now Colonel) Butler, in his *Birds of the Deccan and South Mahratta Country*, says that the Great Rufous Wren Warbler is probably a permanent resident; it is also not uncommon in Northern Guzerat and on Mount Aboo. I cannot find any record of a nest having been taken in Western India, but Mr. Hume in *Nests and Eggs of Indian Birds* describes the nests as being a somewhat shallow, flimsy, watch-pocket, loosely put together, composed of coarse grass, and having a good deal of wool mixed with it; it is lined with fine grass.

Captain Cock, who took the eggs at Seetapore, says they breed in August, and that the eggs are facsimiles of those of *Pratincola ferrea*, *i.e.*, of a pale greenish-blue colour, minutely speckled with rufous, principally at the larger end. The size is not given.

Mr. Davidson asks, "Is this a good species?" as birds which he at first considered to be this, and which he sent to Mr. Hume, were identified by Mr. Sharp as specimens of *Drymœca sylvatica* in seasonal plumage.

545.—THE JUNGLE WREN WARBLER.

Drymœca sylvatica, Jerd.

The Jungle Wren Warbler occurs in Central India and Khandeish; it has not been recorded from the Deccan, Guzerat or from Sind.

I found it breeding near Neemuch in July ; the nest was purse-shaped, composed of rough grass, and contained three fresh eggs, pale greenish-white in colour, thickly freckled with rusty-red ; the specks were much more numerous at the larger end. Another nest taken at the same place, early in August, contained five eggs, similar in size and shape, but having the ground colour very pale greenish-white.

Mr. Davidson found them to be far from uncommon in Western Khandeish, and he informs me that the number of eggs is usually four, occasionally five ; he remarks that the eggs vary much, from pale bluish-white unspotted, to pinkish and bluish-white much marked with rusty-red.

They measure 0·69 inches in length by about 0·49 in breadth.

Neemuch, July to August.	*H. E. Barnes.*
Saugor, July to September.	*Do.*
Western Khandeish, July to September.	*J. Davidson, C.S.*

545*bis*.—THE GREAT WREN WARBLER.

Drymœca insignis.

Mr. Littledale found many nests, which he considered as belonging to this species ; he describes the nests as domed, composed of fine grass, interwoven with growing grass. I have never met with the bird.

Baroda, July to September.	*H. E. Barnes.*

550.—THE STREAKED WREN WARBLER.

Burnesia gracilis, Rüpp.

The Streaked Wren Warbler is a common permanent resident in Sind, frequenting the dense tamarisk thickets that occur so commonly on the dhunds. It is somewhat rare in Guzerat, and does not occur at all in the Deccan.

It breeds from May to September ; the nest is built in a low dense tamarisk bush, and is of an oval shape, with the entrance hole at one side near the top, and is composed of small dry tamarisk twigs and fine grass, well lined with soft vegetable down. The eggs, three in number, are greenish-white in colour, profusely streaked, speckled and spotted with bright brownish-red. The markings are usually more numerous at the larger end, where they not unfrequently form an imperfeet zone or cap. In shape they are broad ovals, pointed at one end, measuring 0·55 inches in length by about 0·42 in breadth.

Hydrabad, Sind, June to August. *H. E. Barnes.*

550*bis.*—THE STREAKED SCRUB WARBLER.

Scotocerca inquieta, Rüpp.

The Streaked Scrub Warbler has been procured on the hills that divide Sind from Khelat, where it is most probably a permanent resident : it has not been recorded from any other part of Western India.

They breed freely on the plain between Chaman and Gatai, in Southern Afghanistan, and also in the Pishin Valley, and I have seen the birds during the breeding season in the Bolan Pass.

The nest is globular in shape, not unlike that of the Rufous-fronted Wren Warbler (*Franklinia buchanani*), but is somewhat larger ; it is usually built in a stunted bush not more than two feet from the ground ; it is well lined with feathers and fine grass, the outer portion consisting of coarse grass and fibres.

The maximum number of eggs is six, but four incubated ones are often met with; they are oval in shape, white, with a pinkish tinge when fresh, very minutely spotted and freckled with bright red. These spots are usually more dense at the larger end, but frequently they are evenly speckled over the whole surface.

They average 0·64 inches in length by 0·49 in breadth.

Chaman, South Afghanistan, March to April. *H. S. Barnes.*
Pishin Valley, ,, *March.* ,,

551.—THE RUFOUS-FRONTED WREN WARBLER.

Franklinia buchanani, Bly.

The Rufous-fronted Wren Warbler is common in Sind, and is most abundant in Guzerat and Rajpootana, and Mr. Davidson found it to be very common in Western Khandeish, but with the exception of Ahmednugger (from whence it has been recorded by Mr. Fairbank) it appears to be absent from the southern portion of the Presidency.

It is a permanent resident where found, breeding during the monsoons. The nest is a loose, ragged structure, of an irregular purse-like shape, occasionally almost globular, with the aperture near the top, rarely cup-shaped. It is composed of fine grass, and is lined with soft vegetable down. It is generally placed in a low thorny bush, not more than a foot or so from the ground.

The eggs, four or five in number, as often one as the other, are of a slightly elongated oval shape, and are white in colour, thickly spotted and speckled with dingy or purplish-red. In most eggs the markings are densest at the larger end, where they not infrequently form an irregular zone or cap.

In length they measure about 0·62 inches by nearly 0·48 in breadth.

Deesa, June and July.	*H. E. Barnes.*
Hydrabad, July and August.	,,
Neemuch, July to September.	,,
Dhulia, Khandeish, June to October.	*J. Davidson, C.S.*

553.—SYKES' TREE WARBLER.

Hypolais rama, Sykes.

Sykes' Tree Warbler occurs more or less commonly throughout Western India, in most places only as a cold-weather visitor, but in Sind it is a permanent resident.

Mr. Doig found them breeding most abundantly from March to July. He says (*Stray Feathers,* Vol. IX., p. 280):—

"Locally they are very numerous, as I collected upwards of 90 or 100 eggs in one field, about 8 acres in size. They build in stunted tamarisk bushes, or rather in bushes of this kind, which were originally cut down to admit of cultivation being carried on and which afterwards had again sprouted. These bushes are very dense, and in their centre is situated the nest, composed of sedge, with a little soft grass reed. The eggs are as a rule four in number, and are of a dull white ground, with brown spots, the large end having as a rule a ring round it of most delicate, fine, hair-like brown lines, something similar to the tracing to be seen on eggs of the Common Wren Warbler (*Drymœca inornata*)."

I found a nest containing young ones just hatched, and a few fragments of shells, which I carefully preserved, in a small bush at the foot of the Khojak, near Chaman, South Afghanistan. I did not see the bird, and it was not until I received a clutch of eggs from Mr. Doig, that I was able to fix the identity.

I have also received eggs taken by a friend close to Karachi.

The eggs are broad oval in shape, averaging 0·615 inches in length by 0·495 in breadth.

Eastern Narra, Sind, March to July. *S. B. Doig.*
Chaman, South Afghanistan, May. *H. E. Barnes.*

583*bis*.—THE DESERT WARBLER.

Sylvia nana, Hemp. and Ehr.

This bird occurs in the Sind deserts and also in the Runn of Cutch.

Mr. Doig found young birds just able to fly at the latter place.

This is all I can find on record regarding this bird, which personally I have never met with.

Runn of Cutch, 13*th Nov.* (*young only*). *S. B. Doig.*

589.—THE PIED WAGTAIL.

Motacilla maderaspatensis, Gm.

The Pied Wagtail is very generally distributed throughout the Presidency; it is a permanent resident, breeding nearly the whole year through.

They have several broods during the season.

One pair, that frequented a small tank adjoining my compound at Poona, had a nest with two young ones and an addled egg on the 3rd March; on the 23rd April I took three incubated eggs from the same nest; they made another nest about a yard away from the first one, which contained two eggs on the 9th May. In July I noticed them feeding a pair of young birds, and towards the end of August, they were making preparations for another brood; so that this pair had at least five clutches of eggs in one year. They were the only Wagtails on the tank and were very pugnacious, and would allow no other bird to remain on the tank; their own young ones, as soon as they were able to forage for themselves, were even driven away.

The nest, which is a mere pad, composed of grass, sedges, fibres, &c., is always near water, and is built upon something solid, such as the ledge of a rock, a niche in a stone bridge or wall, a hole in a bank or well, or any such similar place.

The eggs, three or four in number, vary much both in size and shape, but are always more or less pointed at one end. The general colour is greenish or earthy-white, spotted, speckled, streaked, clouded or smudged with olive-, purplish-, or earthy-brown.

They average 0·9 inches in length by about 0·65 in breadth.

600.—THE INDIAN TITLARK.

Corydalla rufula, Vieill.

The Indian Titlark appears to be a common permanent resident throughout Western India, breeding from about the middle of March to the commencement of June. I think they have at least two broods during the season. The nest, composed of grass roots and stems, is usually placed in the centre of a clump of coarse grass (resting on the ground), occasionally under the shelter afforded by a clod of earth. The nest is practically cup-shaped, but many, especially when in the first named situation, have a small quantity of grass sprinkled lightly over the nest, as if by accident, which effectually hides it from all those who are not in possession of the secret.

The eggs, from two to four in number, are oval in shape and dingy brownish-white in colour, profusely speckled and spotted with brownish-red and umber-brown, more densely so at the larger end. The eggs are liable to variation both in size and colour, but the average is about 0·8 inches in length by about 0·6 in breadth.

THE BUTTERFLIES OF THE CENTRAL PROVINCES.

By J. A. B.

The Central Provinces, consisting of nineteen districts, are situated almost in the centre of the Indian Peninsula. Roughly speaking, they are bounded on the east by the Bengal Presidency, on the north by the North-West Provinces and Central Indian Native States; on the west by the Bombay Presidency; and on the south by Berar, the Nizam's Territory and the Madras Presidency.* Most of the country which borders these provinces, however, does not belong to the British Government, and, as a fact, only 160 miles of the borders march with English territory, out of a total of 2,700 miles. They are thus almost entirely isolated from other purely British provinces. They are geographically divided into two parts by the Satpura range of mountains. Commencing in the east at the peak of Amarkantak, 3,500 high, these mountains stretch away till they meet the Western Ghats, gradually decreasing in height as they trend westwards, although many of the peaks and plateaux have a higher elevation than has Amarkantak. The highest peak is Dhupgarh, 4,500 feet, a thousand higher than the Pachmarhi plateau and sanitarium, which it overlooks. The hills go away in two ranges, between which there is a table land, and on which are situated the districts of Balaghat, Seoni, Chindwara, and Betul. The table land is broken up and diversified by numerous ranges and peaks, and valleys of various extent, height and depth, each range bearing a local name. The table-land closes in on the west, and the two main ranges run north and south of the Tapti River, joining the Rajpipla Hills in Khandesh, and another tract of hilly country, till the Western Ghats are reached. North of the Satpura Hills lies the plain of the Narbada Valley, and north of this again there is a plateau on which are situated the districts of Damoh and Saugor, the eastern scarp of which is bounded by the Bhanrer and Kaimur hills, both offshoots of the Vindhyan range. South of the Satpuras lie the plains of Nagpur and Chhattisgarh, and to the east of Chhattisgarh is the plain of Sambalpur. Chhattisgarh and Sambalpur are drained by the Mahanadi. South of the Nagpur plains flows the Godaveri. Both these rivers flow to the east and empty themselves into the Bay of Bengal, while the Tapti and Narbada flow to the west into the Arabian Sea. There are several other large rivers in the Provinces, all tributaries of the four great rivers already mentioned. To the north of the Chhattisgarh and Sambalpur plains there are ranges of hills, a continuation of the Satpuras, but of lower elevation, covered for the most part with dense jungle, and south of these two plains lie the forest-clad hills of Jeypore and Bastar, the latter country extending away to the Godavery, south of the Nagpur plain, where there is another large tract of forest country.

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* Their length is, from east to west, about 600 miles, and their breadth from north to south, about 500 miles. Their area is about 113,000 square miles, of which 84,200 are English, and 28,800 Feudatory territory.

The Central Provinces, it will thus be seen, is generally a mountainous country, with plateaux, plains, hills and valleys breaking up and diversifying its surface, and giving to it a greater variety of scenery than, perhaps, is to be met with in any other part of India. It may not be so grand as in many other districts, but for variety and charm I think these Provinces hold their own against many more celebrated and better known.

The year is divided into three seasons—the cold season, the hot season, and the rainy sason, four months of each. On the plateaux the climate is usually cool, even during the hottest part of the year, and during the winter frost is not uncommon. In the plains the cold weather is the pleasantest time, but it is a pity that it does not last long enough. The rains are moderate, ranging from thirty to sixty inches in the various parts of the Provinces, the greater rainfall, of course, being where the forests are thickest, and the lesser where the open country predominates. The hot weather in the plateaux is not at all unpleasant, the nights being always cool; and even in the plains this is usually the case. During the day, however, the hot weather in the plains is burdensome, for a fierce wind, like the breath from a furnace, rages, and the thermometer shows a high register—one hundred degrees being about the average. To protect ourselves we have to resort to the grateful and fragrant *khas-khas tattie,* the gently swinging punka, and the softly murmuring thermantidote.

As we have three seasons, so there are three periods of the year when butterflies do most prevail—these times being at the change of the seasons in February, June, and October. The butterflies that have two seasonal broods only come out in June and October and the latter brood would appear to hybernate; for in February, when numerous other species appear in lovely freshness, the "seasonal brooded" butterflies appear, but none of these double-brooded butterflies have I seen in February that seem fresh and new. The best times for procuring these in their different forms is in June and October, and October is undoubtedly the best month in all the year for every variety of butterfly.

I have prepared a list of all the butterflies that have been collected by myself in the Central Provinces, together with a few notes about them. From Mr. Lionel de Nicéville, the author of "The Butterflies of India, Burmah and Ceylon," I have received much help in compiling these notes. I had been a collector of butterflies and other Natural History "curiosities" off and on since I was a boy at school. The study of entomology, and particularly of Lepidoptera, was fostered in our young minds by the existence, in our midst, of a scientific master, who used to appropriate all our best specimens: but at the same time, be it said in justice to him, he always gave a prize for the best classified collection of butterflies and moths at the end of the midsummer term. When I came out to India, and saw the immense variety of Nature's works around me, I set about collecting those which could most easily be preserved. Birds, a specimen or so of each, I have skinned of every kind that I could come across; snakes, lizards, eggs, fossils, &c., I have collected, and last but not least (to my mind), butterflies and moths. But all in a desultory sort of way. I could never classify anything except perhaps the birds (thanks to dear old Jerdon) because I had no books to refer to. In the mofussil, where my lines have been chiefly cast, libraries are few and far between, while, where these do exist, works of reference on Natural History do not usually find in them a place. I made several collections of Butterflies, all gone to rack and ruin, alas ! and was in despair of ever getting my specimens named till about eight years ago, when Mr. de Nicéville made an appeal for help to enable him to get together materials for the publication of his great work. I at once responded to his appeal, and the result has been that I have been able to name my specimens through his kindness. I used to send him all my specimens till 1883, when I had to go home on sick leave; but on coming out again in the following year I thought I might as well begin a classified collection for myself. It was not, however, till 1886 that I was able to take it up as thoroughly as I could wish. Much of the Central Provinces is not favorable for the collector; but the ground was then quite new, for, as far as I know, no one else had before me taken up this branch of Natural History in these parts with an eye to working it up. There is no doubt that the Satpura Hills, and the forests all over the Provinces, would, if properly worked, yield many rare species. There may still be some new to science, and I think that almost as many other species as those I have obtained may eventually be found to exist. One species, a *Melanitis,* quite new to science, was discovered in 1886, and there is no reason why there should not be others in these remote hills and forests to delight the hearts of collectors. The collection and study of butterflies in this country is a most fascinating and delightful way of improving one's leisure hours. In the first place, their variety is so infinite, their colouring so exquisite and wonderful, and each day may reveal a prize. It is splendid exercise also and trains one's eyes to observe. There is nothing more pleasant than a walk in the jungle with a net, when there is no chance of getting any larger game, and consequently useless to take out a gun. Armed with a net one can get as much exercise as one wants, and with a killing bottle for other insects, the Naturalist returns to his tents with a hearty appetite for breakfast, and his pockets full of treasures, to be put away, examined, and set up at some future time. The habits of many of our Indian butterflies are of much interest. Each has a different style. Old gardens, full of ancient orange, lime, custard-apple and mango tree, and overgrown with weeds and wild flowers, or else a glade at the head of a mountain ravine, are about as good places as there are to observe them. Come along to such a spot as the last indicated, and let us watch and study them. We have taken a long walk from the plateau, and having descended a winding path, by the side of which hurries along a little stream, rushing over pebbles and boulders, flinging itself over great black rocks in tiny sparkling cascades, foaming at one moment and the next gliding smoothly under huge old mango trees, covered with many an orchid and tree fern, we arrive at a small plain. The plain is backed, on the side where the stream now quietly murmurs along, by dark crags; on the other it goes away, till it meets the opposite hill slope. The plain is covered by rank herbage, most noticeable among it being the Khāns grass (*Saccharum spontaneum*), its graceful silken plumes rustling and nodding to the breeze which comes whispering through the trees on the margin of the plain. We have now come to the end of the plain, which closes in rather abruptly, and have to cross the stream which we observe is beautifully clear and limpid. Shoals of tiny silvery fish dart away in terror at our approach, and scores of exquisitely coloured dragon-flies, their wings and bodies glittering like living gems, rise from the weeds and rushes at the edge of and in the water, and rustle away with quivering wings. The shores of the stream are sandy, and our way winds along it under the shade of graceful forest trees. Our favourite hunting ground is near. The stream turns at a sharp angle and plunges through dark rocks into chasms of unknown depth. At the entrance of the glen we are now exploring are some magnificent old mango trees, their roots entwined amongst the rocks, their boughs o'ershadowing the stream and the path along which we are wandering. The glen is full of small trees, growing between boulders, and is covered with various plants bearing flowers of sweet odour, and of every imaginable hue. Beyond the glen or glade the ground goes suddenly away to a ravine, running towards the direction of the setting sun, and as we approach the edge we are aware of a strong breeze coming fresh over the hills and up from the ravine, bringing from its depths the sound of falling waters far below and the sweet and mellow whistle of the Malabar Whistling Thrush (*Myiophonus horsfieldi*), or the "Schoolboy" as it is popularly called. Under the mango trees, at the entrance of the glen, where the air is still, are seen floating along those very common but most exquisitely graceful of all butterflies, the several kinds of *Danainæ*, *Danais limniace*, pale blue, veined with black; *D. chrysippus*, tawny red, relieved by pure white and black; *D. genutia* of the same colouring, with the addition of black veins; and *Euplœa core*, velvety black embroidered with white. They sail and float along in the most aërial yet lazy way, as much as to say, "Oh, yes! we know we are handsome, but it's no matter, for no one will touch us." They settle in scores on the plants around without an attempt at concealment; they seem to know that nothing will dare touch them, they are so tough, so leathery and by no means savoury morsels to judge from the unpleasant odour they all exhale—a protection afforded them by Nature to keep off the attacks of all enemies of the Butterfly tribe, except those of the human race, alack! This natural protection seems to have been taken advantage of by other butterflies, who mimic the shape and color of the commoner kinds; but of this more in its proper place. Each step we now take through the trees disturbs scores of *Nymphalidæ*. The *Satyrinæ* are represented by various kinds of *Lethe, Melanitis, Mycalesis* and *Ypthima,* while nearly all the *Junoniæ,* various kinds of *Neptis, Athyma, Symphædra* and *Precis iphita* represent the *Nymphalinæ*. "Skippers," too, glance away from many a leaf, and "blues" and "coppers" twinkle away into the grass and up into the trees. *Absara suffusa,* "that embodiment of *vanity*" (see Mr. Aitken in our Society's Journal,*) jostles and challenges every other butterfly that passes by. Among the dead leaves it is hard to distinguish *Precis iphita,* the *Melanites, Mycaleses* and *Ypthimæ.* As we go deeper into the shade, close up to the rocks, and come back towards the stream, sudden flashes of blue and gold reveal to our wondering eyes the existence of *Kallima inachis,* the great "leaf butterfly." As sudden as was its appearance, so is its disappearance, and we cannot for the life of us make out what has become of it. Surely we saw it settle under that bit of overhanging rock, or was it on the trunk of that tree that is close to the path? Where is the nymph that so suddenly disclosed herself and as suddenly vanished. Look closely and examine every square inch of rock and tree-trunk surface. Here's an old and withered leaf—can she be enclosed within it? Try! The net is dropped over the *leaf,* and up rises our wild and wayward nymph, captive and struggling, as beautiful a creation as was ever made in Nature's wonderful workshop. As we go on the sprightly *Symphædra nais,* with various species of the genus *Junonia,* equally as sprightly, rise rapidly from almost beneath our feet, and skim along to other spots several yards ahead, where they settle again with fanning wings. The *Neptes* and *Athyma perius*—so hard to distinguish the one from the other when on the wing, their general colouring and manner of flight so closely resembling one another—rise with a graceful spring and float along on expanded wing, settling again on the upper surface of the leaves not very far ahead. They literally *float* along, for they expand their wings and seem scarce to flutter them, so that, when on a level with the eye, they disappear and re-appear in quite a wonderful way. Many species of *Ypthima* flutter feebly out of the grass and dance away along the path and in and out the stems of grass. The *Catopsiliæ* come with a series of vigorous, bounding sweeps and curves; they all look as if they were hurrying to catch the last train, but were undecided which course to steer. A few "swallow-tails" are seen majestically sailing along, *P. polymnestor* flashing out in its livery of black and azure, while *P. nomius*, with delicate pale green wings, "zebra-marked," flutters in and out the bushes. Wherever the ground is slightly moist they most do seem to congregate, and on some chosen spots, apparently not different to many close by, they cluster literally in scores, one might say hundreds, presenting a most lovely and animated appearance, as they eagerly suck up the moisture through their trunks. Among them we may see a *Charaxes* or two—these are grand creatures in their manner of flight, such power, such ease, such swiftness! Disturbed, they are off like lightning, and disappear from sight like spirits; but one has only to wait, and back they come to the same spot, so that by a stealthy approach and one swift movement of the net they are captured.

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* Vol. I., page 215 (*A. fraterna* and *A. suffusa,* perhaps, are the same butterfly).

Down in the khuds and in the deepest shade we come across the *Kallima* and *Melanitis* again, as well as various kinds of *Hesperidæ*, that are crepuscular in their habits.

A *Melanitis*, when disturbed during the day, acts for all the world just as an owl does, and hurries along as if it could not see properly, in irregular waves of flight, knocking up against anything that happens to be in the way. But only wait till evening, just when the sun has set, for—

> It is the hour, when from the boughs
> The nightingale's high note is heard;
> It is the hour when lovers' vows
> Seem sweet in every whisper'd word—
> And gentle winds and waters near,
> Make music to the lonely ear.
> Each flower the dews have lightly wet,
> And in the sky the stars are met,
> And on the wave is deeper blue,
> And on the leaf a browner hue,
> And in the heaven that clear obscure,
> So softly dark, and darkly pure,
> Which follows the decline of day,
> As twilight melts beneath the moon away—

and then the *Melanites* come out and dance beneath the shade of lofty trees like so many elves. They flit about and have aerial duels, or perhaps the movement gone through may best be likened to that in the "Sir Roger de Coverley," when the couples come out and manœuvre singly and together. The other *Melanites* sit by on the lower bushes, and watch each couple or trio enjoying themselves. They are so engrossed in this amusement, that by gently walking into their midst one's presence does not disturb them, and they will come and settle on one's head, shoulders, and outstretched hands. I, too, as noted by Mr. Aitkin, have seen many of them go straight up into the sky and clean out of sight. I have noticed this in the early morning as well as in the evening. I suppose the reason is that they have so long been snugly lying hidden under the bushes that they love to get some of the freshness high up in the air. By searching closely and waving one's net gently over the surface of the rocks, the dusk-loving "skippers" are put up. Watch where they settle, and go gently up to the spot. Drop the net, extended by being held at the bottom, quietly over the place, and the "skipper" rushes out only to be captured.

The shades of evening are now falling, and we must hasten back to our camp, otherwise we might meet a panther or even a tiger just about to commence his nightly prowl. The jackals are already beginning to wake the echoes with their unearthly howls, and the ghastly chuckle of the horned owl comes from out the depths of those dark old trees. The Night-jar repeats monotonously his notes like the sound of a stone sent skipping along the ice, and the air is filled with the whirr and buzz of beetles and the chirp and tinkle, as of tiny bells, of innumerable crickets and grasshoppers. As we climb to the top of the ravine, and look back over it and away to the west, toward the setting sun, our eyes and hearts are gladdened by the sight of a lovely, soft, yet exquisitely beautiful and radiant glow like unto the colour of an amethyst—a glory which fills the air and floods hill and forest. Above in the sky the glow is red like rubies, fading away into carmine, and higher up, into the clear pale blue of an Indian evening sky. Below in the valleys the shades are purpling and deepening into the grey of night, and the mists are rising and strike cold and ghost-like. 'Tis a scene of enchantment from which we must tear ourselves away—a glory which cannot be seen often and which will live in our memories for ever.

As we get up on the high level and catch sight of our tents, the lights from which shine cheerily out, it is already night and the glorious array of "stars come rushing out" from a deep still blue sky filling the air with a pale radiance which enables us to see our way quite plainly. It is as glorious a night as it has been a day, and we sit down with enjoyment to our dinners, after which a pipe and a mild whisky and soda send us happy and contented to bed.

The butterflies given in the accompanying list,* with very few exceptions (which will be noted), have all been actually taken by myself, so that I can vouch for their being strictly "butterflies of the Central Provinces." The few that I have not taken myself have been caught by natives who have collected for me.

To be continued.

A PRELIMINARY LIST OF THE BUTTERFLIES OF MYSORE.

By E. Y. Watson.

In October, 1888, an opportunity offering, I availed myself of it to send my native collector to catch butterflies in Mysore. The opportunity in question was, that the late Government Geologist of Madras, Mr. Bosworth Smith, was going on a prospecting tour from Kolar in the east to Kathlekan in the west of Mysore, at which latter place he proposed staying for about a couple of months. Collecting was carried on at all the halts *en route* between Kolar and Kathlekan, and Mr. Bosworth Smith carefully noted on each specimen the place of capture. Between Kolar and Banavar the jungle consisted of low scrub, and here, as might be expected, the prevailing genus was *Teracolus*; this genus almost entirely disappears after Kadur, where the jungle changes to forest more or less thick, and here the prevailing genera are *Melanitis* and *Mycalesis*. Of the former genus many very curious examples were obtained, some of which appear to belong to an undescribed genus. Although I directed my collector's attention particularly to *Yphthimas*, of which he obtained a very large number of specimens, yet only the two generally distributed species *huebneri* and *philomela* were represented. The species most worthy of notice is *Arhopala bazalus,* of which a single specimen was obtained at the Gersoppa Falls, this species being hitherto only recorded from Assam and Sikkim. With the exception of the *Hesperiidæ,* of which very few species were obtained, the collection will be found to be fairly representative; though without doubt, if collecting could have been carried out during the rains, numerous species would have been added—the months October to February, during which the collection was made, practically representing the dry season. I had hopes of being able to collect personally in Mysore during the rainy season of 1889, but was not able to do so; and here I am in Burmah with no chance of visiting Mysore for some years to come, so I have thought it best to publish this list, incomplete as it is, in the hopes that some more fortunate person may be able to add to it hereafter, and will find it of some use to start from.

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* The list will be published in the next part of this paper.

I have also included in this list a few species obtained by myself at Nelamangala and Soldevanhalli, two villages in the neighbourhood of Bangalore.

The following is a complete list of the places near which specimens were obtained, with their approximate height :—

Kolar, Kolar District	2,552 ft.
Bangalore, Bangalore District	3,000 ft.
Nelamangala do. do.	3,000 ft.
Soldevanhalli do. do.	3,000 ft.
Nittur, Tumkur do. do.	2,700 ft.
Kippenhally do. do.	2,734 ft.
Arsikare, Hassan do.	2,666 ft.
Banavar, Kadur do.	2,550 ft.
Kadur do. do.	2,550 ft.
Tarikare do. do.	2,235 ft.
Lukvalli do. do.	2,200 ft.
* Kathlekan do. do.	2,000 to 4,000 ft.
Sagar, Shimoga District	1,970 ft.
Gersoppa Falls, Shimoga District	1,670 ft.

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* This is a Coffee estate, where the bulk of the collection was made.

NYMPHALIDÆ.

[NOTE.—The species marked thus* have been named by Mr. de Nicéville.]

* 1. Hestia lynceus, Drury (*malabarica*, Moore). Kathlekan, November. Numerous specimens.

2. Danais limniace, Cramer, Bangalore, October; Tarikare, November; Sagar, Kathlekan, Nelamangala, January. Numerous specimens.

3. Danais chrysippus, Linnæus. Nelamangala, January. Common.

4. Danais genutia, Cramer, Nelamangala, January. Common. Tarikari, November. One male.

5. Danais aglea, Cramer (*grammica*, Boisduval). Kathlekan, Lukvalli, November. Numerous specimens.

6. Euplœa core, Cramer. Bangalore, October; Kathlekan, Arsikare, Kadur, Banavar, Lukvalli, November; Sagar, Gersoppa Falls, January. Very numerous specimens.

7. Euplœa coreoides, Moore. Kadur, November; Kathlekan, November and January. A few specimens.

8. Mycalesis anaxias, Hewitson. Kathlekan, November. A single specimen.

9. Mycalesis mandata, Moore. Typical, Kathlekan, November. A few specimens. Transitional to Mandosa, Kathlekan, November and December. A few specimens.

10. Mycalesis mandosa, Butler. Kathlekan, November, December, and January. Very numerous specimens.

11. Mycalesis mineus, Linnæus. Kathlekan, November, December, January. Very common, but only the dry weather forms, *visala* and *indistans*, met with.

12. Mycalesis junonia, Butler. Lukvalli, November; Kathlekan, November, December, January. Very numerous.

13. Lethe todara, Moore. Kathlekan, November. Numerous specimens.

14. Lethe neilgheriiensis, Guérin. Kathlekan, Lukvalli, November. A few specimens.

15. Yphthima philomela, Johansen. Lukvalli, Kadur, November; Kathlekan, November, December, January. Very numerous specimens.

16. Yphthima huebneri, Kirby. Lukvalli, Tarikare, November; Kathlekan, November, December, January. Very numerous specimens; the great majority of this and the preceding being and *marshallii howra* respectively.

17. Melanitis leda, Linnæus. Typical: Kolar, October; Lukvalli, November. Two specimens. Transitional; Lukvalli, November; Kathlekan, December. Two specimens. *Ismene*; Lukvalli, November; Kathlekan November, December. Very numerous specimens.

*18. Melanitis bela, Moore. Kathlekan, November, December, January. Numerous specimens, presenting some very curious varieties.

*19. Melanitis gnophodes, Butler. Kathlekan, November, December. A few specimens. The underside of this species does not seem to vary very much, and is very similar to some varieties of *ismene*.

*20. Melanitis sp. Kathlekan, November, December. Four specimens; these may possibly be very aberrant forms of *M. bela*.

*21. Discophora lepida, Moore. Kathlekan, November. A single female.

22. Telchinia violæ, Fabricius. Kadur, November; Nelamangala, January. Common.

23. Ergolis ariadne, Linnæus. Kolar, October; Banavar, Lukvalli, Kathlekan, November. Common.

24. Byblia ilithyia, Drury. Kolar, October. A few specimens.

25. Cupha erymanthis, Drury. Gersoppa Falls, January. A few specimens.

26. Atella phalanta, Drury. Kolar, Bangalore, October; Tarikare, November; Nelamangala, January. Very common.

27. Cynthia saloma, Swinhoe. Gersoppa Falls, January. A single male.

28. Precisiphita, Cramer. Lukvalli, November; Kathlekan, November, December, January. Common.

29. Junonia almana, Linnæus. Tarikare, November; Kathlekan, Lukvalli, December. Common.

30. Junonia asterie, Linnæus. Kathlekan, November. A single worn specimen.

31. Junonia lemonias, Linnæus. Bangalore, October; Kadur, Arsikari, November; Nelamangala, January. Common.

32. Junonia hierta, Fabricius. Kolar, October; Tarikare, Kadur, November; Nelamangala, January. Common.

33. Junonia orithya, Linnæus. Kolar, October; Kadur, Banavar, November; Nelamangala, January. Common.

*34\. Neptis hordonia, Stoll. Lukvalli, November; Kathlekan, November, December. A few specimens.

*35\. Neptis viraja, Moore. Kathlekan, November. Two specimens.

*36\. Neptis varmona, Moore. Lukvalli, November; Kathlekan. November, December, January. Numerous specimens.

*37\. Neptis swinhoei, Butler. Kathlekan, December; Sagar, Gersoppa Falls, January. A few specimens.

*38\. Neptis kallaura, Moore. Kathlekan, November. A single female.

*39\. Neptis nandina, Moore. Kathlekan, November. A single female.

*40\. Neptis ophiana, Moore. Kadur, November. A single male.

*41\. Cirrhochroa relata, de Nicéville. Gersoppa Falls, January. A single male.

42. Hypolimnas bolina, Linnæus. Nittur, November; Gersoppa Falls, January. A few specimens.

43. Hypolimnas misippus, Linnæus. Kadur, Banavar, November; Gersoppa Falls, January. Numerous males.

44. Parthenos virens, Moore. Gersoppa Falls, January Two specimens.

45. Limenitis procris, Cramer. Kathlekan, November. A single specimen.

*46\. Athyma mahesa, Moore. Gersoppa Falls, January. Three males.

*47. Athyma selenophora, Kolar. Gersoppa Falls, January. One male.

*48. Athyma inarina, Butler. Kathlekan, November. One male.

*49. Symphaedra nais, Forster. Kolar, October; Nelamangala, January. Common. Gersoppa Falls, January. A single specimen.

50. Euthalia evelina, Stoll. Gersoppa Falls, January. A single male.

51. Euthalia lepidea, Butler. Kathlekan, November, December; Gersoppa Falls, January. A few specimens.

52. Euthalia garuda, Moore. Gersoppa Falls, December. A few specimens.

53. Pyrameis cardui, Linnæus. Kadur, November. A single specimen.

54. Vanessa canace, Linnæus. Gersoppa Falls, January. A single worn specimen.

55. Cyrestis thyodamas, Boisduval. Kathlekan, November; Gersoppa Falls, January. Numerous specimens.

56. Charaxes athamas, Drury. Kathlekan, November. A single specimen.

57. Charaxes imna, Butler. Kathlekan, November. Two males.

LEMONIIDÆ.

58. Abisara suffusa, Moore. Kathlekan, November, December, January; Gersoppa Falls, January. Numerous specimens.

LYCÆNIDŒ.

*59. Curetis bulis Doubleday, Hewitson. Kathlekan, November, December, January. Two males, one female.

60. Curetis thetys, Drury. Kathlekan, November, December, January; Gersoppa Falls, January. Two males three females.

61. Cyaniris albidisca, Moore. Kathlekan, November; Gersoppa Falls, January. A few males.

62. Cyaniris limbatus, Moore. Lukvalli, November; Gersoppa Falls, January. Numerous specimens.

63. Cyanirls akasa, Horsfield. Kathlekan, November. A single specimen.

64. Chilades putli, Kolar. Nelamangala, January. One specimen.

65. Zizera pygmæa, Snellin. Kolar, October. One specimen.

66. Zizera ossa, Swinhoe. Kolar, October; Arsikari, Kathlekan, November; Nelamangala, January. A few specimens.

*67. Azanus gamra, Lederer. Kolar, October. A few specimens.

68. Tarucus plinius, Fabricius. Kolar, October; Kippenhally, Banavar, November. A few specimens.

69. Castalius rosimon, Fabricius. Kolar, October; Kathlekan, Arsikari, Lukvalli, November. Common.

70. Castalius ethion, Doubleday, Hewitson. Arsikari, November. A single male.

71. Castalius interruptus, Moore. Kathlekan, November. One specimen.

72. Everes parrhasius, Fabricius. Lukvalli, November; Kathlekan, November, December, January. Numerous specimens.

73. Jamides bochus, Cramer. Tarikari, Arsikari, November. Two males.

*74. Lycaenesthes lycænina, Felder. Kathlekan, November. One specimen.

*75. Nacaduba dana, de Nicéville. Kadur, Kathlekan, November. Numerous specimens.

76. Nacaduba hampsoni, de Nicéville. Kathlekan, November. A few specimens.

77. Calochrysops strabo, Fabricius. Kadur, Arsikari, November; Kathlekan, Sagar, January. Numerous specimens.

78. Calochrysops cnejus, Fabricius. Kolar, October; Tarikari, Arsikari, Kathlekan, Lukvalli, November; Gersoppa Falls, January. Numerous specimens.

79. Polyommatus boeticus, Linnæus. Arsikari, Kathlekan, November; Sagar, Nelamangala, January. A few specimens.

80. Lampides ælianus, Fabricius. Kolar, Bangalore, October; Kathlekan, December; Lukvalli, Arsikari, Kippenhally, November. Numerous specimens. Var. *alexis*, Kolar, Bangalore, October; Arsikari, November; Gersoppa Falls, January. A few specimens.

81. Lampides elpis, Godart. Kathlekan, November; Gersoppa Falls, January. A few specimens.

82. Talicada nyseus, Guérin. Kolar, October; Kathlekan, November; Sagar, Nelamangala, January. A few specimens.

83. Virachola isocrates, Fabricius. Kolar, October. A single female.

*84. Aphnæus elima, Moore. Kolar, Bangalore, October. A few specimens.

*85. Aphnæus vulcanus, Fabricius. Kolar, October; Soldevanhalli, January. Two specimens.

*86. Aphnæus lilacinus, Moore. Bangalore, October. A single specimen.

*87. Aphnæus sp. Kathlekan, November. A single specimen.

*88. Bindhara sugriva, Horsfield. Gersoppa Falls, January. Two males, one female.

*89. Arhopala canaraica, Moore. Gersoppa Falls, January. A few specimens.

*90. Arhopala bazalus, Hewitson. Gersoppa Falls, January. A single specimen.

91. Arhopala amantes, Hewitson. Gersoppa Falls, Sagar, January. Numerous specimens.

92. Arhopala centaurus Fabricius. Gersoppa Falls, Sagar, January. A few specimens.

PAPILIONIDÆ.—PIERINÆ.

93. Nychitona xiphia, Fabricius. Lukvalli, Tarikare, Nittur, November. A few specimens.

94. Terias hecabe, Linnæus. Kolar, Bangalore, October; Kadur, Nittur, Banavar, Kippenhally, November. Numerous specimens. Form *excavata*, Moore. Kolar, Bangalore, October. A few specimens.

95. Terias purreea, Butler. Kolar, Bangalore, October. A few specimens.

96. Terias drona, Horsfield. Kolar, October; Tarikari, November; Soldevanhalli, January. A few specimens.

97. Catopsilia catilla, Cramer. Kolar, Bangalore, October; Kathlekan, November. Common.

98. Catopsilia crocale, Cramer. Kolar, October. A few specimens.

99. Catopsilia pyranthe, Fabricius. Kolar, October. A few specimens.

100. Catopsilia gnoma, Fabricius. Kolar, October; Tarikari, November. A few specimens.

101. Belenois mesentina, Cramer. Nittur, November. Numerous specimens.

102. Ixias marianne, Cramer. Kolar, October; Kippenhally, Tarikari, November. A few specimens.

103. Ixias pyrene, Linnæus. Kolar, October; Tarikari, Lukvalli, November. A few specimens.

104. Teracolus etrida, Boisduval. Kolar, October. A few specimens.

105. Teracolus danæ, Fabricius. Kolar, October; Kippenhally, Arsikari, Banavar, Nittur, November. Numerous specimens.

106. Teracolus amata, Fabricius. Kolar, Bangalore, October; Tarikari, Arsikari, Banavar, Nittur, Kippenhally. Very numerous specimens.

*107. Teracolus eucharis, Fabricius. Kolar, October; Nittur, Banavar, Kadur, Arsikari, Kippenhally, November. Numerous males and a few females.

*108. Catophaga hippo, Linnæus. Kathlekan, December. One female.

109. Catophaga sp. (lankapura ?). Kathlekan, November. A single male.

110. Huphina phryne, Fabricius. Kolar, October; Tarikari, Nittur, Banavar, Kippenhally, Kathlekan, November. Numerous specimens.

111. Nepheronea sp. (gœa ?). Kathlekan, November. A few specimens.

112. Delias eucharis, Drury. Arsikari, Kadur, Kathlekan, November ; Sagar, January. Numerous specimens.

PAPILIONINÆ.

*113. Ornithoptera minos, Cramer. Kathlekan, November. A single female.

114. Papilio dissimilis, Linnæus. Kathlekan, December, January. Two specimens.

115. Papilio panope, Linnæus. Kadur, November ; Kathlekan November, December, January. A few specimens.

116. Papilio hector, Linnæus. Kolar, October ; Nelamangala, January. Common.

117. Papilio aristolochiæ, Fabricius. Sagar, Kathlekan, January. A few specimens.

118. Papilio erithronius, Cramer. Bangalore, October; Lukvalli, Kippenhally, Tarikari, November ; Kathlekan, November, December, January ; Nelamangala, January. Very common.

119. Papilio pammon, Linnæus. Kathlekan, December, January. Two specimens.

HESPERIIDÆ.

120. Astictopterus salsala, Moore. Kathlekan November. Two specimens.

121. Chapra mathias, Fabricius. Kolar, October ; Lukvalli, November. Numerous specimens.

122. Tagiades obscurus, Mabille. Gersoppa Falls, January. Several specimens.

*123. Plesioneura restricta, Moore. Gersoppa Falls, January ; Lukvalli, November. Two specimens.

*124. Coladenia dau, Fabricius. Lukvalli, November. A single specimen.

NOTES ON INDIAN ANTS.

By George Alexander J. Rothney, F.E.S.

(*Read before the Entomological Society, London, 3rd April 1889.*)

The following notes (which I have been encouraged to offer to the Society by the kind assurance of my friend Mr. Edward Saunders that they might be of some interest to hymenopterists) are confined to my written memoranda of a few only of the more conspicuous or interesting of the Indian species which have been constantly under my observation from March 1872 to March 1886.

Now that I have left India, I often feel sorry I did not turn to better account such a splendid field for the study of these most fascinating insects, but the calls and duties of a business life, and the necessity of spending much of one's spare time in outdoor sports, which in India means not only relaxation but health, very greatly reduce the leisure available for steady entomological work, and, as these notes will show, almost restrict one's observations to Sundays and holidays; still there have been many neglected opportunities, and I shall always regret having failed to find the female of *Dorylus*, and to dig up a satisfactory nest of *Holcomyrmex indicus.*

Looking back on Indian ants generally, it is strongly impressed upon my mind by many an unrecorded observation that not only do different species vary as widely in habits and character as do the numerous and distinct nationalities inhabiting this wonderful country, but that individuals of the same species will occasionally exhibit, when under apparently similar conditions and circumstances, different little traits and dispositions, so that if you attempt to fix any hard and fast lines as to ant-conduct you are apt to find your calculations and theories somewhat upset.

Mr. Edward Saunders has kindly assisted me in determining some of the ant-puzzles, and I am happy to say that my Indian collections of Hymenoptera are now in Mr. Cameron's able hands for description.

Camponotus compressus, Formica compressa, Fabr.

The Black Ant of India.

This species is very common in Bengal, and can be seen in numbers almost everywhere, but it becomes comparatively rare as you get up-country to Oudh, the North-West Provinces, and the Punjaub, where its place seems to be taken by *Myrmecocystus viaticus*; the two species can be taken in the same locality, but as *viaticus* becomes common, *compressus* is seen less frequently; Benares, Agra, and Lahore are good illustrations of this. *Compressus* is very common in Madras, and I have also taken it in Bombay. The nests are formed in the earth at a depth of several inches, generally under the shelter of trees, and are very populous. The sexes swarm in May or early June, and take flight as soon as the sun goes down. Stray specimens of the sexes, however, may be taken at light from the commencement of the hot weather to the end of the rains (April to September). The workers-major are very fierce and strong, and attack when disturbed with the greatest courage; if you allow them to fasten on your hand they can draw blood with ease, their strong mandibles cutting like a pair of nail scissors; when once they get a good hold, unless you unlock their jaws, they will leave their heads fixed in the wound rather than loosen their bull-dog grip.

It is amusing to watch the havoc these big workers will play with the white ants (Termites) whenever they get the chance. Very probably the trunk of the tree under which *compressus* has formed its colony will be plastered with the covered ways of Termites; take a stick and uncover these, and *compressus* will immediately rush in and carry off the soft helpless Termites to their nest; but they never have the sense or industry to open up any of these prolific finds for themselves, even when the key or start is given them, although with their immense strength they could very easily do so.

It is a very common occurrence to find evidence of deadly family feuds between these warriors, such as two lying dead, locked together, and another walking about with a big head fixed to a leg or antenna: but of many observations of a similar character, I will relate the details of a particularly desperate fight that took place in the verandah of my bungalow in Barrackpore between a worker-major (not a very big specimen) and a nest of that pungently stinging ant, *Solenopsis gemminatus*. One afternoon in May, 1880, at 4-30 p.m., I noticed a worker of *compressus* very busy skirmishing round a column of the verandah, in which was a strong colony of *Solenopsis*; she contented herself for some time in cutting off and snipping in two the stragglers from the nest, but by-and-bye she became bolder, and came closer to the nest, seizing and cutting away with the most systematic determination; by stooping down a little you could dis-distinctly hear the snip, snip of the mandibles as they severed heads and bodies of the apparently unoffending *gemminatus*. This went on till 5-30, when *compressus* commenced an attack on the main entrance to the nest itself; and now the fight became more general. After a rapid dash at the entrance *compressus* would retreat, covered with these little red ants; some would be jerked off, but the more pertinacious required individual clearing, and I noticed *compressus* adopted a very clever plan of freeing her legs from the enemy: say one or more ants were holding on to her leg, she would then encircle that limb with her mandibles above the hold of the red ants, and then, instead of moving the jaws, would draw the leg through, a process very like shredding currants; of course *gemminatus* would often get a hold where this process could not be applied, but *compressus* always managed to free herself at last, and then off to the entrance again for a fresh attack. Twice while watching, *compressus*, covered with red ants, rolled from the base of the column to the steps below, but as soon as she freed herself, up she mounted again and renewed the fight. At 6 o'clock I went for the usual evening drive, and left my friend hard at it. On my return at 8 the fight was still going on, although it was then dark, and *compressus* was showing evident signs of exhaustion. At 9-30 I went out again to see how matters stood, and found *compressus* still alive, but covered with foes and almost done to death. I picked her up, cleaned off the red ants, brought her indoors, put her in a comfortable open box, and prepared some syrup of sugar and sherry, but on going to the box the next morning I was grieved to find her stiff and dead. I have always regretted I did not mix her syrup with brandy or port instead of sherry, but I fear she was past recovery. After bringing her in the night before, I went back with a light and gathered up some of the dead from the battle-field, and of the odds and ends of heads and bodies. I made out next day some 53 slain, but the total must have been much greater, as I did not succeed in picking up in the defective light of a wall-lamp, anything like the whole of the killed. I should be inclined to estimate the total as near 150 to 200. I did not observe any wounded; *compressus* did her work too effectively for that.

Beyond a pure love of a good scrimmage I can offer no suggestion as to any reason or cause for this fight; *gemminatus* was wholly unoffending, and *compressus* might have left the battle-field with colours flying any time from 4-30 up to 8 p.m. I have seen many instances of *compressus'* pugnacity when coming across other ants, or crossing close to another nest, but never such a systematic determined affair as the one described. I have this Hereward of ants in my collection now, with a few odds and ends of the slain. I have examined a great many nests of *compressus*, but have never succeeded in finding in them any other species of ants, Coleoptera, Aphidæ, or indeed insects of any kind.

Myrmecocystus viatica (Fabr.).

Cataglyphis viatica.

This ant is common in the North-West Provinces, Oudh, and the Punjaub. I have also taken it in Tirhoot, but never in the Calcutta district. It forms its nests in the hard-baked earth in the most exposed situations, and seems to revel in the hot dry air and fierce sun of these parts. You can always find plenty of nests in the broken ground about Agra, and also in the pathways of the gardens at Benares. The workers, which vary immensely in size, can be found busy and active all the year round, but the sexes I have only obtained in May. The workers have a strong propensity for marching about in irregular lines of a dozen or twenty together; they march at a great pace, but I have never been able to detect any particular object in these excursions, and have never seen them attacking other ants, or bringing home any plunder. The workers-major, however, are very fond of carrying their smaller brethren when on the march, which they do by striding over and holding them clear of the ground with their mandibles; if you disturb them the big worker drops the little one, and each makes off on its own account, but if left alone, and you watch quietly for a little time, you may see the big ant pick up the little one and march on again in a great hurry, and as if to make up for the delay. I have examined many of the nests of this species, but never found any slave-ants or insects of any kind in them. The big workers are powerful ants, but do not possess the immense strength of the giant workers of the *compressus*.

Camponotus sylvaticus, Oliv.

This is a common species in Bengal, and can be found on most tree-trunks; it delights in shade, and forms its nests (which are never populous) in the ground under leaves. The workers are very active and extremely fragile, and it is difficult to secure perfect specimens. Specimens even from the same nest will vary greatly in colour.

Polyrhachis lævissimus, Sm.

This ant forms its nests in the decayed wood of trees, covering the entrances to its burrows with a thick papyraceous material, which might be best described as a " small-hands " made in the substance of a " tissue"; it is by no means a common ant, and I have hardly found half-a-dozen nests during my residence in India, and these have all been in Bengal. My finest nest is situated in a tree (a species of Acacia) in Barrackpore Park, on the south side of the tennis-ground, close to the Chirya Khana (aviary). This nest has a web stretched across a portion of the decayed trunk fully 18 inches broad by 2 feet in length, and is very populous; this nest swarms about the commencement of the rains, June 15th to July 7th. It is a strikingly handsome species, with its shining jet-black head and body, relieved and set off by the red legs. It often reminded me of our English *F. fuliginosa* in general appearance and habits, and always seemed like an old friend, but though I spent many hours for many years watching this nest, I never detected any special trait or character worth recording. I never found any other species in the nest nor Aphidæ, and, as far as I could observe, the ants derived their nourishment from the rich, black, moist mould of the decaying wood. They are a gentle species of ant, and can be handled without inconvenience.

Polyrhachis Schrinax, Roger.

This ant forms its nest by binding together with one or two silky threads a couple of leaves of a shrub; it only contains a few individuals, and is decidedly rare. The same remarks apply to *Polyrhachis bicolor*, Smith.

Polyrhachis spiniger, Mayr.

This is a common species in Bengal, but the nests are not easily found; they are formed by web-work binding together a few twigs of a spiny shrub like a dwarf babool, and I have not found them in any other plant. This species was described from specimens taken in the Botanical Gardens, Calcutta.

Pseudomyrma bicolor, Guer., Sm

Sima rufo-nigra (*nigrum*), Jerdon.

This species (the female of which is figured and described by Frederick Smith in the Entomological Transactions for March, 1875, from my specimens taken at Barrackpore) is very common in Bengal; it forms its nests in the dead (but not decayed) wood of trees, and it can always be met with scouring over the trunks, particularly of fruit-trees, like the mango (*Mangifera indica*), bael (*Ægle marmelos*), and lychee (*Nephelium Lichi*). Though so generally common, the nests are not easy to find, and I only met with two thoroughly well-established colonies that could be visited and watched year after year (the first was situated in a tree in Barrackpore Road, opposite the Park-gates, just where the trunk-road turns off by the Club; the other in a small tree in the Park, in some waste ground by the viceregal kitchen-garden. These nests I have spent hours in watching from 1874 to 1886). It is a very pugnacious species, and attacks almost any insect that comes in its way; I say almost, for I have seen it distinctly avoid the big workers of *compressus*, and on one or two occasions also the workers of *Œcophylla smaragdina*, when placed at a slight disadvantage in the way of position and numbers; it is armed with a very powerful sting, which inflicts by far the most painful and lasting wound of any hymenopterous insect I am acquainted with, and I have had experience of the stings of most Indian bees, wasps, and ants. It is very possible this may be considered by many who know the ant as too high an estimate of its stinging powers, but there are stings and stings. I have had hundreds of casual ones, and thought no more of them than of the stings of a *Polistes* or *Pompilus*; but once allow this ant to get a firm hold with its mandibles, and then, doubling its body, plunge its sting, so to speak, up to the hilt, and go on stinging, and the result is an entomological experience that few would care to try again. I have had several of these little experiences, and will give the following details of the worst:—

I was out collecting in Barrackpore Park, and one of these ants got on my left hand and stung me just under a heavy snake-ring I was wearing. I was foolish enough to allow it to operate in the above-mentioned thorough fashion before I brushed her off, and never thought of removing the ring until the finger was too swollen to do so. On my return home I tried to reduce the swelling with ice, but without success; the whole hand puffed out, the inflammation extending right up the arm to the shoulder; the finger itself turned blue, and looked and felt like bursting. I spent a wretched night, and the first thing in the morning sent to the bazaar for a native jeweller (Johari), who cut the ring off for me, but it was a painful operation, and it was two days before I was quite right again. I was in perfect health at the time and in the football training, which will give some idea of the effect of the poison when *rufo-nigra* has sufficient time to make a really deliberate and well-sustained sting.

In my compound at No. 45 Cantonment, Barrackpore, I had a very fine baël-tree, covered every year with fruit, of which my mali (native gardener) was especially fond; but the tree was much frequented by *Pseudomyrma*, and little "Adjun-mali" never went up to pick the fruit without expressing many anathemas on this particular species of ant.

I have never found any swarming time for this species, but have taken specimens of the winged female at different times during the hot weather and rains, but generally in May; but altogether I have not captured more than about twenty specimens. From May 20th to 24th, in 1879 to 1882, I captured each year a single female sitting on a leaf of the mussel-shell creeper, *Clitoria ternatea*, on the east side of the Chirya Khana (aviary), Barrackpore Park, and in almost the same position. What the attraction for this particular spot was I could never make out, and there were no nests in the immediate neighbourhood.

Wherever you find this species in any numbers, if you watch a few moments, you will see a mimicking spider, *Salticus*, running about amongst the ants, which it very closely resembles in appearance, much more so in life than in set specimens placed side by side; in my two favourite nests I have seen numbers on the most friendly footing with the ants, though I have never seen them enter their burrows. I have never seen these spiders doing anything, or capturing any fly or other insect, though they are always very busy and in a great hurry; they are very quick in their movements, and are difficult to capture, and, being very fragile, good specimens are not very easily obtained. I have at times fancied I have seen them imbibing some of the moisture from the bark where it has been bruised or chafed, but I cannot be certain : they are evidently on a special footing with the ants, and are, I should say, the only friends *Pseudomyrma* has, with the exception of a sand-wasp, a new species of *Rhinopsis* since described by Mr. Cameron, which also very closely mimics *rufo-nigra*, and which, on first observing amongst the workers, I took to be the male. It is very active; I have seen three specimens (but only captured one), two at the nest in the Barrackpore Road, and one at the nest in the Park.*

S. rufo-nigra appears to be fairly omnivorous, preying on live insects, such as flies, moths, other ants, or anything it can capture; it is also very fond of over-ripe fruit, and there is a species of fig in the Park, the fruit of which (about the size of a medlar) is always riddled with these ants. I have not, however, found it on carrion, as I have the workers of *Dorylus* and *Solenopsis*.

I have never observed the workers fighting amongst themselves in the immediate neighbourhood of their own nest, but on other trees it is not an uncommon occurrence to find little parties of six or eight engaged in deadly battle. In May, 1883, I found five couples locked in a death struggle on the trunk of a casuarina-tree; I secured them, and they did not let go their hold on being put in the collecting-bottle, but died as they fought. It seems probable that these were workers from different nests engaged in hunting, and a common object had brought them into collision.

S. rufo-nigra and *Œcophylla smaragdina*, Fabr.—In 1883 *smaragdina*, which had never for the previous ten years been a very common ant in Barrackpore, appeared in large numbers, and advanced from tree to tree along the trunk-road; it came up opposite the Club and the Park-gates, where the road turns round to the parade-ground and Pulta. I watched the position of affairs with much interest, as

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* It is perhaps curious and worthy of remark that a species of *Ampulex* should so exactly mimic this ant and mix with it on friendly terms, whilst another species, the handsome *compressum*, should behave towards it in the somewhat overbearing and rough manner I have elsewhere described.

smaragdina had only the road to cross,—one big tree and one telegraph-post,—and they would be on to my favourite nest of *rufo-nigra.* This was in March, but it was not until April that *smaragdina* crossed the road, and I observed the workers gathering in numbers about the end of the big tree and the telegraph-post, but my tree was still unmolested. On Sunday, April 29th, however, the fight commenced; *smaragdina* were clustering round the tree, and making futile efforts to ascend, for *rufo-nigra* mustered in strength in a ring round the base of the trunk, and successfully repelled every effort of *smaragdina* to effect a lodgment. Ant for ant *rufo-nigra* was far more than a match for *smaragdina*, and the *yellow* ants were routed by the *red and black.* There were (as far as I could see) no killed on either side, and when I left, after watching some hours, *rufo-nigra* was master of the situation, and *smaragdina* retiring to the big tree and telegraph-post.

The next Sunday, May 6th, I again visited the tree, and to my suprise a great change had taken place in the position of the two species. There were no yellow ants round the base of the tree, but *smaragdina* appeared in great numbers high up on the trunk on the north side, and were descending towards the *red and black* in the shape of a wedge, the base spreading almost across the north side of the trunk, then tapering off to a point, the apex being formed by a *single* ant supported by *two,* the *two* by a line of three or four, and so on. When I arrived this *spear-head* of ants was about two feet above the entrance of *Pseudomyrma's* nest (which was a little on the west side of the tree); it was not advancing, but almost stationary, the only movement being made by the few forming the apex: *rufo-nigra* clustered in numbers round the entrance to their nest, but did not attempt any counter move in force or combined effort; they contented themselves with light skirmishing with the point of the *smaragdina* formation, but here, though they tried many times, they could make no impression; *rufo-nigra* invariably engaged yellow ant No. 1, the apex; No. 1 instantly backed on Nos. 2 and 3 in the second line, which brought an enemy on either flank, which was too great odds, and *rufo-nigra* would have much difficulty in disengaging herself. This went on for some hours, till I had to leave. I never saw any killed, but the apex of the yellows was once or twice relieved from the rear: *rufo-nigra* was evidently much alarmed, crowding round the entrance to their nest with a restless unmeaning action and generally scared look.

I could never make out how *smaragdina* arrived at the upper part of my tree; either they must have ascended on the south-east side (which was not so much frequented), when *rufo-nigra* was not on the alert, or they must have gone up the telegraph-post and travelled along the wires, which just at one point touched a few of the leaves of my tree. The trees on the right and left of my tree did not touch.

On Sunday, May 13th, I again visited my tree, expecting to find *smaragdina* in possession, but the reverse was the case; there was not a single yellow ant on it, *rufo-nigra* being in sole charge, and the work of the colony going on as usual. What had happened in the meantime I had no means of telling, but I think *smaragdina* must have left the tree of their own accord, and were not driven off.*

On Sunday, May 20th, I again went to my tree, to find another invasion of *smaragdina*, and the wedge-shaped column of yellow ants advancing as on May 6th: this time *rufo-nigra* hardly offered any opposition, and there was a very apparent diminution in their numbers.

On Thursday, May 24th, *smaragdina* had again deserted the tree, and *rufo-nigra* was to the fore.

On Sunday, June 10th, another invasion: *smaragdina* all over the tree, some workers being close to the entrance to *rufo-nigra's* nest; very few of *rufo-nigra* workers about, and these all small-sized specimens; the *red and black* ants almost suppressed.

On Sunday, June 24th, *smaragdina* occupied the upper portion of the tree, *rufo-nigra* the lower, and had regained their nest.

On Sunday, July 22nd, I found *smaragdina* strongly in the ascendant: very few workers of *rufo-nigra* about.

After this date I left off taking *written* notes, but *smaragdina* gradually deserted my tree, and passed on to others; *rufo-nigra* was left in undisputed possession, but the colony was never so populous and prosperous again, and on my leaving India, in 1886, had not entirely recovered from these invasions of the yellow ants.

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* It is possible that as the spear-head formation of yellow ants advanced to a level with *rufo-nigra's* nest, the *red and black* ants may have retired; it would be impossible for *smaragdina* to follow them up, as their size would not permit them to enter the burrows. The yellow column may have then passed on, and *rufo-nigra*, issuing in a body, taken them in flank, and by this skilful manœuvre snatched a victory from defeat; but of course this is mere conjecture, though more unlikely things do happen in ant-life.

In the 'Entomologist's Monthly Magazine' for 1876, pp. 87, 88, I have very fully described a curious phase in the history of this ant, and the beautiful sand-wasp, *Ampulex compressus;* how, on the 1st June, 1876, on the trunk of an old peepul-tree (*Ficus religiosa*), on the road to Pultah and Barrackpore, I found a number of these wasps and ants engaged in a series of battles, or what really describes it more accurately, wrestling-matches, the wasps jerking the ants clear off the tree one after the other; there would be a little fencing and dodging for a hold, especially when two ants at the same time faced a wasp, but *Ampulex* always succeeded in jerking them off the tree. The ants did not appear to be hurt, and I watched several re-ascend the tree and try another fall with their too-powerful opponents. This tree was always much frequented by both *Ampulex* and *Pseudomyrma*, but I have never seen any "tumasha," as the natives would call it, of this sort going on there, either before or since; but on May 20th, 1883, on a peepul-tree in Barrackpore Park, I observed a single specimen of *Ampulex* jerking ants off the trunk, mostly *rufo-nigras*, but in this case there was some apparent reason; both ants and wasps were attracted to the same spot by some sort of sticky secretion exuding from the bark, and ants and wasp consequently collided, with the result that the former were jerked off as described; only a few of the *rufo-nigras* offered any opposition or made any fight, and as before, none of the ants appeared to be much the worse for their falls.

Pseudomyrma carbonaria, Smith.

Sima carbonaria, Smith.

This species is not uncommon in Bengal, and forms its nests in trees, as with *rufo-nigra*. I have only found one or two nests, and these were not populous; my best one was situated in an india-rubber tree (*Ficus*), on the drive from Government House to the Outram Statue, Calcutta. I have only taken one specimen of the winged female. The sting of this ant is sharp and pungent, but not to be compared in power to *rufo-nigra*. There is a species of *Salticus* which mimics this ant, but it is very rare, and there is another spider which also frequents tree-trunks, and closely mimics a *Camponotus*.

Œcophylla smaragdina, Fabr.

This well-known ant is common in Bengal, and forms its nests in trees by drawing together the living leaves with a fine white web, as described in Jerdon's 'Madras Journal.' In 1883 immense numbers of this ant appeared in Barrackpore, advancing from tree to tree along the trunk-road from Calcutta, and they soon took up a strong position in the Park; some of the trees were covered with nests, which are very populous. I noticed that the various *nests* on any *one* tree appeared to form *one colony*, and to live on friendly terms, whereas the ants on a neighbouring tree would be inimical; this I proved by keeping a nest in my verandah for several weeks at a time, and trying a few simple experiments. I found that ants brought from any nest from the same tree as my captive nest were immediately recognised as friends, and received with evident signs of satisfaction; but specimens brought from nests from any other tree were immediately attacked, and unless rescued were killed in the most savage manner. The longest test was only three or four weeks, for by that time my captive ants always began to show signs of failing health, so that I never had the heart to keep them shut up for a longer period. I tried to keep them healthy by a daily supply of fresh leaves, and fed them with sugar, plantains, and other fruits; but they took most kindly to green *Geometra* larvæ taken from newly-made nests of *Eumenes conica*, which were generally handy in the verandah, but either captivity did not agree with them, or I failed in my mode of treatment, for after the third week my captives invariably became more or less feeble and sickly. The following are extracts from my diary:—

May 6th. Brought home with me (with considerable difficulty) a fine strong nest of *Œcophylla smaragdina*, and arranged a comfortable home for it in a large open box in my verandah, isolating it by standing the box on a tin pot resting on a large brick, the brick standing in a large earthenwere saucer of water.

May 24th. Introduced four ants taken from another nest, but from the same tree; these were at once received with marked signs of pleasure, were caressed, and entered the nest with their friends as if perfectly at home.

May 27th. Introduced ten specimens taken from a different tree; these at once showed signs of alarm, and endeavoured to escape; but most of them were seized, and would have been pulled to pieces had I not rescued them.

June 3rd. Introduced some more strangers, who showed alarm and immediately made off till stopped by the water; the captive *smaragdina*, though showing signs of hostility, were too feeble to make any serious attack.

I repeated this experiment many times, varying the intervals of introducing friends and strangers from a few days up to the three weeks, but always with the same result. I then altered the conditions somewhat, and on June 10th cut a fine populous nest from a tree and placed it on the trunk of one a few hundred yards distant, inhabited by another colony. The ants from my nest immediately took possession of the fork where I had placed the nest, overpowering the few ants that happened to be about; but others came streaming down to repel the invaders. My nest continued to pour forth its swarms, and soon the trunk was covered with masses of struggling yellow ants. It was, as far as I could judge, a drawn battle.

I then withdrew my nest, and hung it up to the trunk of a tree frequented by *Pseudomyrma rufo-nigra*. Out sallied the yellow ants, and *rufo-nigra* in alarm made off, and in doing so showed a great amount of discretion; they had not the numbers to make a stand-up fight, but their superior individual strength enabled the few that were attacked to deal out some rapid and effective strokes with mandibles and sting, to wrench themselves clear and escape without injury. I then took the nest of *smaragdina* back to the tree from which I cut it, and the ants were at once received with every sign of pleasure; and, although hundreds must have been left behind on the two trees, the nest appeared to be as populous as ever.

On another occasion I hung a nest of *smaragdina* to a small Palmyra palm in my compound, which was occupied by a strong nest of the yellow wasp, *Polistes hebræus*, but the ants and wasps did not come into contact in any way, although they were only separated about two feet. In this my observations did not agree with the late Mr. Chas. Horne's, who found that *Œcophylla* had a great antipathy to *Polistes;* and in his paper on Hymenoptera from the North-West Provinces gives a very interesting account of the attacks of the yellow ant on the yellow wasp ; but in my case the ants were not quite under natural conditions, which may easily account for their leaving the wasps alone. And I was never able to find *Œcophylla* and *Polistes* inhabiting the same tree ; but I think the observation is of interest as tending to show that ants under slightly altered conditions will often show different traits of character or instinct.

During the time I kept *Œcophylla* in confinement I found they were very stupid in any efforts they made at escape; they would occasionally tumble off the brick island into the water, although within an inch would be a bridge purposely arranged for their use. When *Œcophylla* did fall in the water they collapsed and drowned at once, and seemed incapable of making any attempt to save themselves by swimming an inch or two. Some nests I kept in a large open tin-lined box, which held them securely until the tin lost its smooth surface from exposure, and allowed the ants a foothold, but even then they were very slow to escape.

Diacamma vagans, Sm.

This species is very common in Bengal. You never find it in large numbers, but generally singly, or two or three together; its nests, which are never populous, are usually formed under bricks, stones, or in brick-work, and always in shady situations. It appears to have no regular time for swarming; its sting is sharp, but the pain does not last more than a few seconds.

In the verandah of my bungalow at Barrackpore I had a nice little nest in the brick-work, which I watched for several years, and used to feed the workers with sugar and other sweets. I arranged a little island by means of a brick placed in the centre of a large plate filled with water, covered the brick with sugar, and then with a piece of bamboo made a bridge from the floor to the brick. I left this the whole of one Sunday, but no ants found out the treasure. The following Sunday I captured a *vagans,* marked her with paint, and put her to the sugar ; she immediately seized a grain, crossed the bridge, and made off home to her nest, distant about 35 ft., in a fairly direct line. After depositing the sugar she was out again in a few seconds, made her way back to the island, took another grain of sugar (she usually selected the largest), then back to the nest. I watched about a dozen journeys, and after the first two her track was as near a straight line to the sugar as could be. A few workers came out from her nest and stood about the entrance, but she took no notice of them. I do not know how many journeys she made that day, as I had to leave for the evening drive.

The next Sunday I arranged the sugar island in the same place. There were a good many ants of different species walking about, but none found the way to the sugar. In about an hour out came my marked ant, and after a little wandering about found the bridge, and then followed the rapid journeys to and fro with the sugar. She never appeared to eat any herself, her great desire being to get all she could stored in her nest.

The next Sunday the same process went on, but with this slight difference: this time some of her own fellow-workers seemed inclined to follow her and watch her movements, and my marked ant, after going one or two direct journeys, then altered her mode of travelling to a very irregular and zigzag course, and generally assumed a casual and uncertain air. I watched her closely, and am quite certain she wished to bamboozle her friends, and keep all the credit and "kudos" of bringing home the treasure to herself. She kept up these roundabout journeys to and from the island until I left for the usual drive.

I carried on these experiments for many successive Sundays, but no other ants from this nest found out the island. A small species of *Tapinoma* did, and came in numbers every Sunday, and at last a worker of *vagans* from another nest at the other end of my verandah, distant about 50 ft., found out the bridge, I think by accident, but had the enterprise to cross, seize a piece of sugar, and off to her nest. After this I always had a marked ant going backwards and forwards with sugar on the left side, and an unmarked ant doing the same on the right side, and little *Tapinoma* swarming all over the place with the grains, but no other ants found out the sugar island. Sometimes the two workers of *vagans* met on the brick or bridge, but never took any notice of each other; they were too much wrapt up in their work for that.

I should mention that I always arranged my island within a few feet of the same spot, and now I often wonder why I never changed the position completely, and then watched the result.

After reading Sir John Lubbock's most charming work on ants, I thought I would try a few simple experiments to see if I could influence my ants by means of colours. I first scattered sugar about my verandah for a day or two, by which means I attracted considerable numbers of ants of different genera and species, particularly *Diacamma*, *Solenopsis*, and *Tapinoma*. I then placed sugar on different coloured cards (subsequently substituting the intensely brilliant colours of surface-papers for the cards), making various changes from time to time according to my judgment. These experiments I kept up for a good many weeks, but I could never find that colour influenced my ants in any way. I do not attach any value to this, as my experiments were very crude, and generally interrupted by the gaps of from Sunday to Sunday, and I only mention the circumstance as affording some traits of ant character. *Tapinoma* was always first at the sugar, and swarmed indiscriminately over everything alike.

Diacamma vagans was fairly quick at the sugar, but appeared to be influenced chiefly by the card nearest her nest, and perhaps in some degree by the one with the finest grains.

Solenopsis gemminatus seemed only to blunder on the cards by accident, and without, as far as I could observe, any particular signs of intelligence. *Tapinoma* ate sugar on the spot, and also carried off grains. *Diacamma* carried off the sugar as fast as possible, but ate none. *Solenopsis* ate sugar on the spot, but did not carry any away.

By alarming the ants by striking the cards, shaking the paper, or dropping fine powdered sugar on them, *Diacamma vagans* and *Tapinoma* would give a little start, but, recovering themselves instantly, would seize the nearest and biggest grain, and make off at express speed. *Solenopsis* would start, sometimes tumble over one another, and then make off in alarm and without any method or precision. According to my idea, *Diacamma*, by a number of little traits which I cannot describe, but which as a whole made a great impression on me, showed the most intelligence, *Tapinoma* the most audacity. *Solenopsis* I do not like to judge rashly from an imperfect human point of view, so will only say I was disappointed with them generally. I never succeeded in frightening my ants by noise alone; noise had always to be accompanied by an earth tremor or wind.

I several times endeavoured to keep workers of *vagans* in captivity but never with any success; they swarmed up the sides of my highly polished tin-box with ease, and in my island arrangement, which kept *smaragdina* in perfect security, they found their way with wonderful rapidity to the brick surrounded by the moat, and then took to the water without a moment's hesitation, and with one or two strokes with their legs they got over the two or three inches of water with almost the ease and dexterity of a water-boatman.

On one occasion I put two workers in with *smaragdina.* One escaped at once; the other was seized, but fought her way clear, and followed her companion with splendid determination and quickness. It would require much ingenuity to make a receptacle that would safely and conveniently confine this clever ant.

In Barrackpore Park, on the river-drive half-way between "Scandal Point" and Tittaghur Bridge, at one of the prettiest spots in the most beautiful park in Bengal,—I might almost say in India,—is a fine old banyan-tree (*Ficus indica*), with foliage almost touching the ground; it stands on the green slope below the drive, and the breeze, blowing straight up from the broad Tittaghur Reach, makes the shade of this tree delightfully cool in even the heat of May or June. There is in this spot a stone culvert running under the road, the mouth of it opening in the deepest shade of the tree, and on the stones of this culvert you can find almost all the year round, but particularly in the hot weather and rains, numbers of the workers of *Diacamma vagans* congregated together in couples, and engaged in what I take to be a process of shampooing. Two ants will face each other, and fence about and caress with their antennæ, now advancing, now retiring a little; at last one will give a little spring on to the back of the other, and gently and tenderly hold her with her mandibles; then the caressing with the antennæ is renewed, and the legs are also brought into play, and used in much the same way; and lastly, the mandibles will be run gently up and down the limbs. During this operation the ant under treatment will keep time with her antennæ, and stretch out her limbs with evident delight and pleasure: there can be no doubt they thoroughly enjoy themselves. You may watch couples in various stages of this process, which is varied at times by three ants taking part, or by one affecting a kind of coy resistance.

I have mentioned that, although *vagans* is a common ant, you cannot find it in large numbers; neither can you start out from your bungalow collecting with an absolute certainty of finding it; but for *ten years* a visit to this culvert under the shade of this banyan-tree on the river-bank always rewarded you with an interesting group of playing, caressing, shampooing ants. During these ten years I only twice found nests of this species within the radius of this banyan's shade or its immediate vicinity, so that, as a rule, my ants must have travelled some distance in order to enjoy and disport themselves in this delightful retreat.*

I must leave my favourite *vagans* now, for I have no more *written* notes, but from numbers of unrecorded observations extending over the years from March, 1872, to March, 1886, I always look back on this species with much affection, and as an old friend who, under any circumstances and tests, has never disappointed me. Judged from a human point of view (which, however, may not be always strictly fair), I certainly place *D. vagans* as the most intelligent ant it has been my pleasure to observe, and I consider *Chlorion lobatum* the most intelligent amongst sand-wasps.

Solenopsis gemminatus, Fabr.

Solenopsis gemminata, Fabr.

This species is one of the very commonest in Bengal; you can come across it everywhere. It is the *red ant* of India, as *compressus* is the *black*, and *smaragdina* the *yellow*. It forms its nests, which are very populous, in the ground, under bricks or stones in brickwork, or almost anywhere. It appears to swarm several times in the year from March to October, and I have even found the winged sexes in the cold weather from November to February. The workers vary greatly in size, some of the workers-major having immensely-developed heads, but you seldom meet these big fellows walking about; they seem to keep to the nest of good deal, and all my finest specimens have been found by opening up a nest. These ants are very fond of forming covered ways from one point of a colony to another, or in crossing a road, and they both tunnel and build up and are very clever in availing themselves of any little irregularities in the ground, by which they can save themselves labour. For instance, on a piece of smooth even ground, they will build up a covered way, but if their track comes across a stone they will tunnel under it; if a big brick they will skirt the side of it. They do not completely cover in their ways along the whole line; a great part of the track will generally consist of two walls only. The medium-sized workers, as well as the small, take part in these works, but the giant-headed fellows I have never found engaged.

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* I could never find out if the ants that frequented this culvert at any one time were all from the same nest, but I am inclined to think, from their numbers and the smallness of the colonies of *vagans*, that sometimes they were not. I have observed this shampooing going on in other similar situations, but never with the regularity and certainty of this favoured spot.

These ants will come into your bungalows and clear off any loot that may be about, and they seem particularly fond of meat, or any insect you may kill. Supposing you have a flight of cockroaches (*B. orientalis*) come into your room at dinner-time, and in self-defence and to preserve say your soup or glass from being used as a bath you kill one or two, and leave the bodies on the ground, in a very short time, long before you have finished your meal, you will see these bodies apparently become endued with a new life, and travelling at a quite rapid pace across the floor; it is swarms of the little workers of *Solenopsis* carrying off the booty to their nest.

In one bungalow at Barrackpore I had a colony in my verandah formed in one of the masonry columns, and divided into two parts, one in the base and one in the capital, and up and down the column between was a continual stream of ants passing. It occurred to me one day to cut off this passage, which I did by soaking a punkah-cord in kerosine oil, and tying it tightly round the centre of the column. The ants on either side soon surged up in masses to within an inch of the cord, but none could cross the oily barrier. I then formed a little bridge with a piece of bamboo, and fixed it in the brick-work, making a clear span over the cord, and the ends being fixed well in the crowd of ants. I then watched for an hour, but no ants found their way across. I then conducted two or three over, and waited an hour; one of the led ants recrossed, but no others availed themselves of the bridge. I then went for the usual evening drive, and on my return after a couple of hours I found the ants crossing the bridge in numbers. I repeated this experiment many times with exactly the same result. Say barrier fixed at 3 p.m., bridge erected at 4 p.m., and a few ants led over; at 6. p.m. no ants had availed themselves of the bridge, but at 8 p.m., on my return from my drive or tennis, the bridge would be in general use; but never while looking on did the ants avail themselves of the passage, except as mentioned by a led ant recrossing.

On one or two occasions I captured a worker of *Diacamma vagans*, and placed her above the kerosine cord; without a moment's hesitation she ran up the column to the capital, made her way rapidly through the red ants, then along a beam to the next column, then down to the floor of the verandah, and off to her nest without a pause.

Solenopsis offer many strange contrasts of character; they are very clever in making their covered ways, and in finding their own booty, such as described, but when you apply artificial tests of intelligence they altogether fail, and seem to be strangely slow and disappointing.

Holcomyrmex indicus, Mayr.

This ant does not appear to be generally common in Bengal. I have taken it at Nischindipore Nuddea, and in Barrackpore Park, but never in Calcutta or its immediate neighbourhood. It is very plentiful in Barrackpore Park, in the private grounds close to Government House, where it delights in making its nests in the red kunka (ballast) roads, or on any hard dry patch of ground that can be found amongst the grass. The ants swarm early in June, and during the hot months from middle of March to the middle of June you can easily find the nests by the great mounds heaped up round the entrance of empty seed-vessels or husks of grass-seed, I may call it chaff; these mounds will more than fill a pint measure, and I have seen some which I think would fill a quart. If you watch you will see a continuous but straggling stream of ants disappearing down one of the small round entrances to their nests, each carrying a grass-seed, which they bring from the neighbouring grass, and another stream will be seen emerging with the chaff, which they heap up round the entrance in irregular mounds: when these mounds begin to assume any dimensions the labour of piling up the husks is divided; the ant that brings one out will throw it down just outside, or will mount a short distance up the mound, when another will meet and take on the husk and add it to the top, or when the mound is a certain height, will shoot it down on the far side to prevent its tumbling back on the entrance of the nest. Sometimes three or four ants will be engaged in this process, bringing out, passing on, piling up, and shooting down. The ants bringing in the full seeds collect them amongst the grass, which at this time of the year is dry and ripe, and consequently much of the seed is on the ground. I have never observed them ascending the grass-stems to collect the seed. As soon as the *rains* commence—about June 15th—the ants seem to disappear, and although you can find specimens about up to October, they are decidedly scarce.

I have tried very many times to unearth one of these nests, but never (except in one instance) with any success. Directly you dig down a few inches in the hard bricky soil you seem to lose all trace of ants and nest. I have tried various instruments—a garden-knife, a long bodkin, and a kourpi (a very handy native tool)—but have always failed; the way the ants disappear is almost like magic. No doubt I ought to have tried a kodali (native spade), but extensive excavations where these ants formed their nests were hardly practicable without obtaining the permission of the Park authorities, which I never took the trouble to do at the time, though now I have left India I never cease to regret that I did not dig down several feet deep and a yard or two square.

The one exception I have alluded to was a very small nest, situated in the Viceregal kitchen-garden part of the Park, and where the soil was a sort of stiff clay instead of brick-rubble; the tunnels were very small and fine, and there was nothing peculiar about their formation, but in the centre, a few inches from the surface, was a small oval chamber, perfectly smooth and dome-shaped; in this were arranged a number of little round seeds, set out like cheese-cakes on a baker's tray. From the habits of this species I should be inclined to call it the "harvesting ant of Bengal." It was described by Dr. Mayr from my first specimens, which were taken at Nischindipore, having been kindly forwarded by my old friend, the late Mr. Frederick Smith.

Pheidologeton laboriosus, Smith.

This species can generally be found in the neighbourhood of Calcutta or Barrackpore, but it requires a little searching, and I do not think it would attract the notice of any one but an entomologist. The workers vary most immensely in size, the workers-major running through several distinct grades, and no one who had not observed the nest itself could suspect any connection between the noble, handsome, rich red-brown giants of the first grade with the little insignificant yellow workers-minor. These ants form their nests under bricks, stones, flower-pots, rock-work or any spot offering shelter and shade of this nature. You occasionaly meet with them on the march, probably changing their head-quarters, and when doing so they invariably form elaborate and carefully constructed covered ways. The little yellow workers-minor and the smaller grades of the workers-major you may meet with in the open, but the giant workers I have never found except by opening up a nest or covered way. All the workers are pugnacious, and when handled attack you freely, and the small yellow workers and the smaller grades of the workers-major with some effect, but the giants are perfectly harmless, and it makes one feel quite sorry to watch these huge, brave, conscientious, handsome fellows doing their very utmost to grip you with their mandibles, and doubling in their body, as if with the intention to sting, but with absolutely no result.

In forming their covered ways the workers-minor and the smaller grades of workers-major work together most industriously, carrying and piling up the little pieces of soil with great quickness and dexterity, but I have never observed the giants of the first grade so engaged; they, I think, have a special work to perform, which I will describe.

On the river-drive in Barrackpore Park between Scandal Point and Titaghur Bridge, and close to the latter, I found, in the first week of the "rains" in 1883, a splendid covered way in course of construction across the road, which at this point is about 20 ft. wide. There were a large number of ants at work piling up the little red pieces of soorki—(ballast; the soil anywhere about Calcutta or Barrackpore seems to be largely composed of brick and ballast)—and I noticed several of the giant workers also very busy, *not* carrying or building up, but slowly making their way along the line, and here and there stopping and rearing themselves up against the walls, pressing together, and smoothing out in a way which their great size gave them special facility for doing. They used themselves much in the same way as I have seen my mali smooth over the earth with a board when doing a little gardening with belatee (Europe) seeds, or as some of the local rajmistris will also use a board in building a wall. I visited this covered way on a good many successive days, and always found the *giants* busy in this work; they would stand on their hind legs, spread themselves out, and bind together with an even kind of pressure the little blocks or grains of building material. If you picked one up she immediately attacked you in the same thorough, loyal, but perfectly impotent, manner, and when you replaced her she resumed her consolidating form of work. I had (until finding this covered way) often wondered what special use these big fellows served, but I now feel certain this battening process is one. This covered way was cut to pieces and destroyed by the carriages driving up and down every evening, and as regularly repaired by the ants in the early morning. This went on for several weeks, when the ants seemed to pass on, and I lost sight of them. The workers, in traversing their covered way, carried about with them quite an assortment of odds and ends, amongst which I have noticed the larvæ of a Rhyparochromid bug in contiderable numbers, sundry other larvæ unknown, a species of weevil, small shells (*Bulimus*) in some numbers, bits of stick or twigs, seeds, head of an ant, &c.

Dorylus (*longicornis ?*).

Before leaving for India, in 1872, my kind old friend, Mr. Frederick Smith, gave me specimens of the workers and male of *Dorylus*, and thoroughly imbued me with the necessity of discovering the female, and I started for the East with the most perfect confidence of doing so. On my way across from Bombay to Calcutta I stopped at Jubbulpore to visit the Marble Rocks, and while at dinner at the hotel a male flew in to the light; this was my first introduction to this ant, March 6th, 1872.

I had not been long in Calcutta before I found a very promising-looking nest under a large stone at the bottom of an empty tank on the Alipore side of Fort William. I visited this nest two or three evenings a week for some months, feeling certain that some evening my persistence would be rewarded by finding the ants swarming and capturing the female; but I was doomed to disappointment, for on going to the tank one evening I found the water had been let in, and it was being filled for military purposes. I next took the workers in some considerable number in a purchase of pot-plants made at an auction sale at Mackenzie Lyall's; but my next real nest was at Scandal Point, Barrackpore Park, in the earth, and sheltered by one of the wooden seats which are erected there. I examined it very carefully, probing the burrow with a straw, but, though the workers sallied out in some numbers, there was no sign of a female. I was uncertain whether to dig the nest up then and there, or to watch it for some indication of swarming before disturbing the ants. I unfortunately decided on the latter course, for when I went to the spot the next evening there was not an ant to be seen.

My next nest was found in a small brick culvert leading from the old bear-pit, Barrackpore Park, and was formed under a lot of rubbish made up of bits of brick and decayed leaves. This was a fairly populous little colony, and looked a very likely find, and I visited it for several weeks, until one of the Park malis (gardeners), siezed with an extraordinary fit of industry, took it into his head to clear out and tidy up this old drain, which had not been disturbed for years. After this I did not find what might be considered a genuine nest until 1886, but stray lots of the workers could often be found about the Park, particularly at the back of the lions' and tigers' cages, where the old bones were thrown, and which you could generally count on finding covered with the workers; indeed, an old bone or piece of meat seemed to be an irresistible bait to the workers of *Dorylus*.

The males are never found with the workers, but come into your bungalow at night, attracted by the light, generally at dinner-time, when the lamps being turned up the white cloth forms a special attraction; they come buzzing in and blunder about the room much like a *Scarabæus* beetle, and when handled they work vigorously about with their bodies and clip you with the strong claspers of their genital armature. They are by no means uncommon, but what is very curious is that they usually appear at the end of the cold weather or the commencement of the hot, that is, from middle of February to middle of March, when winged ants of other genera can hardly be found.

My last nest of *Dorylus* was found on the Esplanade, Bombay, on January 29th, 1886; it was my last visit to India, and I was starting for an evening walk, when not a hundred yards from the clock-tower of the University I noticed a strong body of the workers very busy round the entrance to a burrow just at the edge of the tuft, and a second glance showed me they had some object in this burrow that they were particularly anxious and jealous about, and, stooping down, I pulled out what from the colouring of the head, legs, and antennæ (so exactly like the workers of *Dorylus*), if I did not actually believe, I at least fondly hoped was the *female,* which I had been looking for for so many years. I rushed back to the Esplanade Hotel, got my collecting-bottle and a knife, returned to the spot, and this time dug up the nest without waiting. I found two more of these suspicious-looking insects, and from the curious, fussy, jealous, and at the same time half-respectful, behaviour of the workers, my hopes as to the genuineness of my find considerably rose. I got three nice little bottles filled with rum, and by the next mail sent them off to Professor Westwood and Mr. Edward Saunders, who kindly wrote me by return of post that my capture was only the "*larva of some Lamellicorn beetle.*" What *Dorylus* does with these larvæ I should much like to know; but my fondest hopes were dashed to the ground, and after fourteen years of careful search I left India, I fear for good, without finding the *female* of *Dorylus.*

Lobopelta diminuta, Smith.

This ant is common enough in Bengal, but I have never found any nest; it is always on the march, and moves in lines two deep, and from a few feet to many yards long. The longest column I have met with was in the Botanical Gardens, Calcutta, and measured a little over thirty yards. It marches at a great pace, and seems to prefer shady and damp situations; a number of the workers will always be seen carrying their pupæ with them, which they do by holding them under their bodies, and walking as it were over them.

Lobopelta chinensis, Mayr.

A common ant in Bengal, but only found in small numbers at a time, sometimes only single specimens, and generally crawling about drains or damp shady ground.

Meranoplus bicolor, Smith.

This pretty little species is common in Bengal, although you only find it sparingly as to numbers; it forms its nests in the earth at a depth of a few inches, and these seldom contain more than twenty to thirty individuals. I have only once found the winged sexes in the nest, *viz.*, in May, 1873, in the Eden Gardens, Calcutta, when I took one female and several males (as described and figured in Frederick Smith's paper in the 'Entomological Transactions' of March, 1875). I have since taken one or two specimens of the female, but always singly. The workers walk about singly or a few together, and very much resemble, both in appearance and habits, the females of some of the small species of *Mutilla;* indeed, I have at times captured a worker of rather above the average size, thinking I had something new in that genus.

Plagiolepis gracilipes, Smith.

Query also *Hypoclinea gracilipes*, Mayr.

This ant is common in Bengal, and can generally be found running about between the stems of the smaller species of bamboo, or behind jaffri (trellis-work), and similar shady situations. The workers are very active, and always seem busy carrying about various species of insects. I have some specimens before me taken with a species of *Pediopsis* (Homopteron) and *Nysius* (Hemipteron), which appear to form a very favourite form of capture.

Aphænogaster.

There are two species of this ant, which are not uncommon in Barrackpore Park in the hot weather; they form their nests in the dried-up grass-covered ground of the open and most exposed positions. One species covers the entrances to its nest with the fallen leaves of the tamarind, acacia, and a thorny shrub like the babool. The other makes tiny mounds of the little pink and blue flowers of a weed that grows amongst the grass; these little mounds, about the diameter of a rupee, and perhaps from one-eighth to one-fourth inch high, are very pretty objects, and from their bright colour easily catch the eye.

Cremastogaster Rothneyi, Mayr.

This pretty little species, which was described from specimens taken in the Eden Gardens, Calcutta, also occurs in Barrackpore Park, but does not appear to be generally common in Bengal; it frequents the trunks of trees, but I never succeeded in finding the nest.

The Mushroom Ant.

There is a species, one of the *Poneridæ,* the males of which come in numbers to light, and settle on the white cloth at dinner-time, or fly about the lamps; it is common from the beginning of the hot weather in March to the beginning of the cold season in November, but I have never been able to find either the workers or females to which it belongs,—that is *knowingly*. From the very strong smell which it has when handled, and which exactly resembles mushrooms, I have given it the above MS. name.

A LIST OF THE VENOMOUS SNAKES OF NORTH KANARA; WITH REMARKS AS TO THE IMPERFECTIONS OF EXISTING RECORDS OF THE DISTRIBUTION OF SNAKES, AND FACTS AND STATISTICS SHOWING THE INFLUENCE OF *ECHIS CARINATA* ON THE DEATH-RATE OF THE BOMBAY PRESIDENCY.

By Mr. G. W. Vidal, C.S.

(*Read at the Society's Meeting on 9th January* 1890.)

The recent contribution to the Society's Museum of a specimen of *Trimeresurus trigonocephalus* from North Kanara adds another species to the comparatively long list of venomous land snakes, of whose occurrence in that district there is already an authentic record.

The list now comprises 9 species, as under:—

No.	Name of Species.	By whom recorded and where deposited.
1	*Naja tripudians*, the Cobra	Specimens deposited in the Karwar Museum.
2	*Ophiophagus elaps*, the Hamadryad.	(1) Live specimen sent to the Society's Rooms by Mr. H. T. Ommanney, C.S.; (2) skins contributed by Col. Peyton deposited in Society's Museum.
3	*Bungarus cœruleus*, the Krait ...	(1) Preserved specimen deposited in the Karwar Museum; (2) specimen contributed to the Society's Collection by Mr. H. S. Wise.
4	*Callophis nigrescens*	Preserved specimen deposited in Society's Museum by Mr. G. Vidal, C.S.
5	*Trimiresurus strigatus*	One specimen contributed to the Society's Collection by Mr. H. S. Wise.
6	*Trimiresurus trigonocephalus* ...	One specimen contributed to the Society's Collection by Mr E. H. Aitken.
7	*Hypnale nepa*, the Carawala......	(1) Specimen contributed to the Society's Collection by Mr. G. Vidal, C.S.; (2) specimen contributed to the Society's Collection by Mr. H. S. Wise.
8	*Daboia Russellii*, the Chain Viper	Specimens deposited in the Karwar Museum.
9	*Echis carinata*	Specimens deposited in the Karwar Museum.

As regards the number of species found, Kanara is decidedly ahead of any other Bombay district. It is a sort of border land where the *fauna* of the densely-wooded and humid Malabar Coast is found side by side with the *fauna* of the dry and bare Deccan plains. The above list, moreover, is probably by no means exhaustive. Sooner or later other tree vipers, specially *T. anamallensis*, which has strayed from the Anamallay Hills to the Mahim Woods near Bombay, may be found in Kanara, together with other representatives of the *genus Callophis*.

But although Kanara shows a large *variety* of venomous snakes the mortality from snake-bite in that district is comparatively low. As will be seen from the statistics given further on, the deaths from snake-bite only average 0·037 *per mille per annum*. The reason for this comparative immunity is that dangerous snakes, and, in particular, the *echis*, which—as I shall endeavour to show later on—is *the* chief instrument of destruction in Western India generally, are not found in inconveniently large numbers, while the Hamadryad and the Krait are decidedly rare.

As our collections increase it is useful to take stock from time to time, however limited may be the field of inquiry selected, to see what additions have been made to our knowledge of the distribution of species. In no branch perhaps of Natural History has the distribution of species been so incompletely worked out, as in the case of the *Ophidia*. A glance at the existing works of reference will show how very little is known of the *habitat* of the great majority of the species described.

Take the case of this particular Tree Viper now received from Kanara. Günther says it is *peculiar* to Ceylon, and Theobald and Nicholson mention no other locality in which it is found. According to the same authorities, *T. anamallensis*, another Tree Viper, of which several specimens, live and pickled, have been procured by members of our Society at Khandalla and the Mahim Woods, occurs only in the Anamallays and the Wynaad. A third tree viper, *T. strigatus*, obtained in North Kanara by Mr. H. S. Wise, has previously been found only in the Nilghiris and the Deccan. Similarly, *Callophis nigrescens*, of which we have specimens both from North Kanara and Mahableshwar, occurs, according to the books, only in the Nilghiris, the Shevaroy Hills, the Wynaad and the Anamallays. Another Callophis, *C. trimaculatus*, whose *habitat*, according to the same authorities, is Tennaserim, and *possibly* Bengal, has lately been received in the Society's Museum from Colaba (Bombay) and Bandora.

In these and scores of similar instances the incompleteness of the record is not without some excuse. But the meagre account of the "Phúrsa" (*Echis carinata*), to be found in all works on Indian snakes, is less excusable. Günther says it is common in many parts of the peninsula of India, in the Anamallay mountains, and in the vicinity of Madras. Fayrer says it is absent from Bengal, common in the North-Western Provinces, the Central Provinces, Punjab, and generally in the south of India. Theobald says it inhabits North-Western and Central India, the Punjab, and Southern India, while Nicholson merely remarks that is not common but widely spread. No mention is made by any of these authorities of the extraordinary abundance in which this viper is found in Sind and the Konkan. The remarkable facts disclosed by the annual official returns showing the results of the measures taken for the extermination of venomous snakes, have been completely ignored. To show the abundance of the *echis* in the Ratnagiri District alone, I give below the number of these snakes killed and brought in for rewards during the six years, 1882-87, in that district, as compared with the total number destroyed in the Bombay Presidency the same period :—

Number of Snakes (*Echis carinata*) destroyed in Ratnagiri.		Number of Snakes destroyed in the Bombay Presidency.	
Year.	Number.	Year.	Number.
1882	238,981	1882	262,348
1883	243,675	1883	293,230
1884	167,603	1884	221,566
1885	240,158	1885	283,579
1886	208,535	1886	266,921
1887	255,378	1887	311,476
Total ...	1,354,330	Total ...	1,639,120
Average of 6 years...	225,721	Average of 6 years.	273,186

I have not at hand the figures for the whole of British India for all the above years. But I find that in 1885 and 1886, the total number of snakes killed in all India is recorded as 420,044, 417,596, respectively. Thus it may safely be concluded that of the whole number of snakes annually destroyed throughout British India, considerably more than one-half, consisting almost exclusively of individuals of the *Echis* species, are killed in Ratnagiri alone! These figures convey a very fair idea of the strength of the "Phúrsa" community in this locality, though they by no means represent the maximum possible number of "Phúrsas" which might be destroyed, if more vigorous measure were adopted. But one looks in vain for any mention of the occurrence of the *Echis* in Ratnagiri in all the books dealing with Indian snakes. It is not indeed very many years since the then head of the Bombay Medical Department, in a list of the poisonous snakes of India, with vernacular names attached, published for the guidance of District officers under the authority of Government, *omitted all mention of the Echis carinata,* and declared the "Phúrsa" of Western India to be identical with *Halys Himalayanus!*

I have assumed above that all or nearly all the snakes destroyed for rewards in Ratnagiri belong to the *Echis* species. In making this assumption, I am relying on past personal observation, as well as arguing from the natural probabilities of the case. The totals may include a few Cobras and Daboias, and possibly a few harmless snakes sometimes find their way into the bags. But the number of snakes other than 'Phúrsas' brought in for rewards in Ratnagiri is so insignificant that for all practical purposes it may be treated as a *quantité négligeable.* The truth is that no other snakes but the *Echis* are, or can be, systematically hunted and found in great numbers. A band of professional snake-charmers would think themselves lucky if they bagged a pair of cobras after a day's search in likely places. A party of Ratnagiri 'Phúrsa' catchers would curse their luck considerably, if their take of 'Phúrsas' averaged less than 50 a day. It is on record that in 1862, when the reward for 'Phúrsas' was tentatively increased from six pies to two annas a snake, 115,921 'Phúrsas' were killed and brought in for rewards in Ratnagiri within eight days (December 2nd to 10th)! At the same rate, had the reward been continued without limit as to total expenditure, five millions of 'Phúrsas' would have been destroyed in one year. But after this alarming display of zeal, the rate of reward was promptly reduced to its former level. The real truth is that notwithstanding the enormous number annually destroyed in Ratnagiri for years and years past, no really serious impression has as yet been made on the 'Phúrsas.' This is clearly shown by the fact that the mortality from snake-bite in Ratnagiri has not sensibly diminished in the last ten years. The reason is that a *limit* is fixed on the total expenditure on rewards.* The rate now in force—three pies per snake—is sufficiently high to make 'Phúrsa' hunting a profitable business. But as no rewards are paid, after the limited grant for the purpose is exhausted, the annual campaign is incomplete and ineffective, and the enemy is left in possession of the field with only such losses as can easily be repaired by the natural fecundity of its species. With the same rate of reward and no limit of expenditure, except the natural limit, when 'Phúrsas' become so rare as to make their pursuit a waste of labour, these snakes, if not quite exterminated, would soon be so reduced in numbers as to be no longer a pest and a constant danger to the population. If the campaign were *vigorously* conducted it would not, I believe, be a very long one. For a year or more the 'Phúrsas' would be killed by millions, instead of as now by lakhs, but the total expenditure would probably not exceed the aggregate and comparatively useless expenditure of the past fifteen years or so.

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* The limit some years ago was Rs. 50 per taluka per month.

I have given above some instances showing more or less excusable omissions in the record of distribution of species. But far worse than these omissions is the surprising error made by Dr. Günther himself, when he gravely states, that "no case is known of its (the *Echis*) bite having proved fatal." At the present day this statement can hardly need refutation. Even as far back as 1855-56, Dr. Imlach, then Civil Surgeon of Shikarpur, in a description of the 'Kapar' (*Echis carinata*), published in the Transactions of the Bombay Medical and Physical Society (*Vide* Vol. III., New Series, p 80), wrote that "a reference to police returns will show that in by far the greatest majority of cases serious injury and death have been caused by the bite of this species." The records of the Ratnagiri Civil Hospital for the last thirty years will tell a similar tale. But even Sir Joseph Fayrer does not seem to have had sufficient information on the subject to enable him to correct the error when he wrote his Thanatophidia. He merely states that "it (*Echis carinata*) is venomous, but Günther says its bite is not known to have proved fatal. This, I think, very doubtful. One in my possession killed a fowl in four minutes, another in two minutes, and a dog in about four hours."

There is indeed no doubt that the *Echis* is a far more potent factor than any other venomous species in swelling the mortality of the Bombay Presidency, and it is important that this fact should be more generally known and recognised than it has been hitherto. It is, of course, impossible to show the exact percentage of the deaths from snake-bite for which the *Echis* is responsible. In the returns no attempt is made to discriminate the species to which the recorded deaths are attributable, and little if any reliance could be placed in the statistics, even if such an attempt were made. But the conclusion stated above may, I think, be fairly drawn from the fact, which is very clear from the returns in their present shape, that in all those districts (*e.g.* Sind and Ratnagiri), where the *Echis* is known to abound, the average mortality from snake-bite is *markedly* high, while conversely, the mortality is insignificant in other districts where the *Echis* is either rare or absent. The following table, which I have compiled with some care and labour from the official returns for the eight years, 1878—85, shows the population, the actual average mortality, and the mortality *per mille* of each district in the Bombay Presidency:—

District.	Population by Census of 1881.	Average actual mortality from snake-bite, 1878 to 1885.	Average mortality per mille, 1878 to 1885.
Hydrabad	754,624	181·7	0·247
Thar and Parkar	203,344	48·7	0·239
Karachi	478,688	87·2	0·182
Ratnagiri	997,090	154·5	0·155
Thana	908,548	108·8	0·119
Panch Mahals	255,479	30·5	0·119
Shikarpur	852,986	72·8	0·085
Surat	614,198	41·5	0·067
Kaira	804,800	47·2	0·0586
Broach	326,930	19·1	0·0584
Upper Sind Frontier	124.181	6·7	0·053
Kolaba	381,649	19·8	0·052
Ahmedabad	856,324	39·6	0·046
Sattara	1,062,350	41·0	0·038
Kanara	421,840	16·0	0·037
Belgaum	864,014	30·2	0·034
Poona	900,621	18·6	0·020
Dharwar	882,907	17·6	0·019
Khandeish	1,237,231	23·1	0·018
Bijapur	638,493	11·0	0·017
Nasik	781,206	10·8	0·0138
Ahmednagar	751,228	10·3	0·0137
Sholapur	582,487	2·2	0·003

Thus three Sind districts and Ratnagiri, in all of which the *Echis* swarms in suitable localities, stand well at the top of the list with an average mortality, taking the four districts together, of ·205 per 1000. On the other hand, in the last four districts on the list, *viz.*, Bijapur, Nasik, Ahmednagar and Sholapur, the combined average mortality per *mille* is only ·0118 In other words only one man dies of snake-bite in about 100,000, in these Deccan districts, while in the *Echis*-ridden tracts one man dies in every 5,000. Daboias and kraits are probably nowhere so common in Western India as to have much appreciable effect on the mortality. But cobras are quite as common, I believe, in these Deccan districts as they are in Ratnagiri or Sind. This shows, I think, pretty conclusively that the *Echis*—and not the cobra, or any other venomous snake—is chiefly responsible for deaths from snake-bite in Bombay.

Enough has been said above to show the importance of having accurate and as far as possible exhaustive records of the distribution of species, and this applies not only to the case of the venomous snakes, with which I have particularly dealt, but to all branches of Natural History. Our Society has already done much useful work in this direction, thanks to the individual as well as collective energy of its members. But a great field is still open to collectors, and much still remains to be done in taking stock, and preparing catalogues of the numerous and valuable contributions already received.

INDIAN CATTLE.

By J. H. Steel, A.V.D.

(*Read at the Society's Meeting on 6th February 1890.*)

Not the least striking feature of life in India is the enormous importance of cattle, and the manner in which they are extensively concerned in trade, agriculture, traffic, and food supply. This is fully recognised in the religions of those peoples who are more essentially the inhabitants of India. Thus sacredness of the cow as an emblem of fruitfulness, and veneration of the bull as a symbol of generative power, are characteristic features of the Hindoo religion, and of these we see as outward and visible signs, the Nundee, or Sacred Bull, occupying an honoured place in the shrines, and the cow wandering freely through the streets, sleek and fat on grain appropriated from the baskets of not unwilling merchants. The sacred injunctions of the religion of the Hindoos seem to have been wisely designed with two aims; firstly, the preservation of cows in time of famine; secondly the devotion of the *best* bulls to service as sires; in this way the welfare of the race of cattle in perpetuity was secured by the powerful influences of custom and superstition. The sacred books of Hindoo and Buddhist, the noble pillars of Asoka, and even the statutes of various conquerors and peaceful invaders of India whose fierce or rude habits have been tamed from time to time by the gentle influences of Hinduism, are full of instruction as to the care to be taken of cattle, and of aphorisms in honour of the bovine race. From time to time Hinduism has been stirred to its depths at wanton or careless affront by slaughter of cattle, and thus the welfare of horned beasts has at times had an influence on history.

But the bullock, though less reverenced than the bull and cow, is even more entitled to honour. He has done good service in every war which has been carried out in India, drawing heavy guns, siege trains, baggage, and supplies, and to European armies he has often been no inconsiderable food supply. In trade he is a most important factor; the strings of bullock carts, which pass along our Bombay streets, the long lines and large herds of Brinjari cattle we meet in some parts of the country, the kind of conveyance which we have to adopt, in the majority of cases, directly we leave the line of rail in out-of-the-way places up-country, are all evidences of this. In agriculture the plough bullock, the ox treading out the corn, and the unfortunate animals engaged at the useful but wearisome work of the well are familiar objects. In food supply the bullock of India has little concern except when he is bought up by the Commissariat at cantonments, or shipped for use by troops on active service. The cow, however, supplies in the form of *ghi*, curds, and other products from milk the staple item of *animal* food consumed by many millions in this country.

Loss of stock by disease or other catastrophe, accordingly, it will be seen, dislocates existence in India. The traveller loses his means of conveyance; the beneficent, but noisy, operation of drawing water for irrigation can no longer be efficiently performed, the ground cannot be tilled, nor the corn threshed; as the plough lies idle so also does the cart, which should be cheerily conveying produce to the line of rail or neighbouring market. Fairs cannot be held; even religion and pleasure are suspended, and military operations are hampered and sometimes prevented by the plague which carries off cattle so frequently in times of war. This is no fanciful picture, but a stern reality familiar to district officers and veterinary surgeons, and painfully evident to Government in its effects on the revenues which are reduced to a minus quantity through the necessity of supplying grain or fresh bullocks to the cultivators.

We often hear surprise expressed that in India care is bestowed on cattle, which ought to first be given to man; but it must be remembered that in supplying to cattle adequate medical treatment, sufficiency of fodder, legislative protection from cruelty, and a special Department to look after their welfare, the public and its Government are but following the dictates of necessity, and fulfilling the requirements of human existence and welfare in this country. The Cow Protection Movement, the development of Pinjrapoles, and the retention alive throughout the country of poor brutes suffering from debility, wounds, or disease are merely exaggerated expressions of a deep current of religious feeling (and of the sound policy which underlies it) with regard to cattle. In this land of ancient and venerable faiths, various rulers have from time to time shown an enlightened policy as regards cattle protection. Even the Mogul Emperors found it judicious to repress any tendency of their followers to wound the susceptibilities of their Hindoo subjects, and, among Mussulman sovereigns, Hyder Ali and his son Tippoo Sahib of Mysore have rendered most excellent services lasting to the present day in their fostering care of the Amrut Mahal breed of cattle, one of the finest in India. History shows that the Hindoo princes, as in Kathiawar, Malwar, Nellore, and elsewhere, also have succeeded in development of fine breeds of cattle, and, indeed, the Mysore dates its fame and origin from the time of Hindoo rule before Hyder.

The Governments of the Honorable Company and that of Her Imperial Majesty have been not unmindful of this important matter. Thus, there is at Hissar in the Punjab a large and important cattle-breeding farm, the influence of which is widely spread through northern India. In Mysore until recently the Amrut-Mahal establishment at Hoonsoor was under the Madras Government, but a few years ago it was transferred to the Mysore State, and now attempts to improve breeding operations are being carried out more less energetically throughout the different parts of the Southern Presidency by distribution of stock from a farm under the Department of Agriculture. In the Bombay Presidency there was a farm at Aligaon, near Sirur, but now a pedigree herd is being raised at the Government experimental farm at Badgaon, in Khandesh, under the Agricultural Department.

Although this important matter receives a certain amount of attention, it had long been felt that more was needed, and that special Cattle Breeding Operations should be carried out by Government similar to those resorted to for improvement of horse stock. This matter is a subject of much debate, but is now generally admitted as one of urgency and interest, for it is found that as the rail increases road traffic lessens, and trade bullocks, being less in demand, are more difficult to procure. Further, it is stated that the Brahmin bull of to-day is inferior to his predecessors, and less reliable as a father of his race, since in the course of time it has become a mere matter of form to present a male animal to the temples, care often not now being taken that the animal so presented is free from blemish, and the best of the herd. Moreover, it is thought that with multiplicity of responsibility has resulted diminished zeal for the welfare of cattle ; that between district officers, agricultural officials, local magnates, and so on, the race of cattle is apt to fall to the ground. Whether these suppositions be thoroughly established or not in detail, it seems to be a general impression that the cattle of India are sadly deteriorating, that old methods of preservation are falling into effeteness through time and superstition, and that something ought to be done to arrest the decline ere it be too late.

Far from being a *laudator temporis acti,* I am a firm believer in modern progress, but I cannot blind myself to the following *evidences of deterioration* :—(1) Military officers have in recent years frequently reported unfavourably on the cattle supplied to them, and it is especially unsatisfactory that the Amrut-Mahal has not invariably sustained its old reputation. (2) There is a widespread opinion among agriculturists, ryots and land-owners, that the cattle of the present day are inferior. (3) Inspecting officers not unfrequently confirm this view. (4) Purchasing committees for army bullocks have to reject extensively for want of stoutness of build and for unsoundness. (5) The Cow Protection Movement has met with an extraordinary degree of success among the agricultural classes, who are specially likely to experience the need for something to be done to improve or prevent deterioration of their cattle. The movement is a sign of the times, even though Sriman Swamy's views be extreme, and his statements and statistics erroneous.

This deterioration is perhaps to an extent to be traced to an unwillingness on the part of the powers that be to interfere between the Native and his cattle; there is a lurking idea that it is bad policy and unpopular for Europeans to have anything whatever to do with Indian cattle, and that, moreover, the Natives know very much more about the cattle of India than Europeans do. Also many Europeans look upon cattle as below their notice, for it is only the district officials who fully realise their importance. But it is bad policy to look upon anything as too common to be worth our notice; on the contrary, the mere fact of the ox rendering us important services entitles him to our best aid and sympathy. That action of the authorities in regulating cattle-breeding would be unpopular is a purely gratuitous assumption, and is disproved apparently by the fact that in many parts of India at various times Native Governments have regulated cattle-breeding with vigour and success, the best breeds of the present day having thus been developed.

That Natives know very much more about cattle than Europeans is a fallacy; they have more crude empirical knowledge as regards cattle management and working, but the sum total of their information is very small and local. The best European authorities on Indian cattle are much better acquainted with the subject than are the Natives, but this is not saying much, for a very great deal has yet to be learned! Among those who have contributed to our knowledge of this important subject are Gilchrist, a surgeon on the Madras Establishment, long serving at Hoonsoor, who wrote a book on "Diseases of Horned Cattle in India"; the late lamented Dr. Shortt, whose small book on Indian Cattle gives useful information; and Professor Wallace, in whose book "India in 1887" are accumulated and arranged photographs of various kinds of cattle, with a description of each in the letterpress. Smaller contributions have been made to the subject but altogether our information is very inconsiderable, and will well admit of expansion and systematisation. In the Government Records are numerous Reports of Cattle Diseases and cognate subjects which deserve careful study, and the official cattle statistics of trade, population, attendance at fairs, imports and exports ought to be carefully worked out if we would thoroughly realise the importance of cattle to India. A little study will show that although Natives know how to feed cattle in this country and can select them for work with much skill, their knowledge fails most lamentably when it comes to deal with injuries and disease, so that the unfortunate animals when most they need scientific care and special nursing, are subjected to barbarous cruelty of treatment, or to utter neglect. Fortunately Government and the public now recognise this unsatisfactory state of affairs, and are taking measures to remedy it.

Much confusion exists even in native nomenclature; for example, we often find a number of terms used in description of cattle which have a very general significance, but might be mistaken to be the names of breeds; thus Hanum cattle are those which come from "down-south" and might be taken to mean Mysori in some parts of the country. In reply to a letter asking the true meaning of the term, I was on one occasion informed it was applied to very small but beautifully-shaped breed of cattle of the Mysore stamp, and coming from the western part of that State, where they run practically wild. Khilari means simply "herd" cattle as contrasted with those tended individually, and Deshi means simply common country cattle. Talabdai, again, is the term applied in Guzerat to local village cattle which have more or less of the blood which we know as Guzerathi. The frequency of these general terms is apt to mislead a casual observer into multiplying breeds unnecessarily and erroneously.

The ox of India is recognized as a species distinct from that of Europe, and is termed by Zoologists the Zebu or Brahmini Ox. The respects in which he differs from his European cousin are—(1) the presence of a hump, (2) lightness of build and agility, (3) large size of the dewlap, (4) certain minor differences of colour and shape. The principal characteristic consists in the presence of a hump. This is similar to the hump of the camel, and consists mainly of fat mixed with the natural fibrous and muscular structure of the withers. It is ornamental and a sexual mark, being much larger in the bull than in either bullock or cow; it varies in size in different breeds, and must be considered as a storehouse of nutriment, serving to adapt the animal to periods of famine exigency which occur frequently in the course of Indian life. In the calf it is not seen, but develops as the animal grows older. Its firmness is a good index of the condition of the animal and is used for this propose by bullock-men who feel it critically but who (with many Europeans) are entirely mistaken in imagining that the presence of the hump is essential to working bullocks. Evidence to the contrary may be seen any day in the Bombay streets, where numerous half-starved bullocks with no hump work under the yoke. No doubt a good full hump and a fat yokecrest, well suited for its work and little liable to gall, go together, but the bullock is in no way dependent on his hump for ability to work under the yoke. (2) The lightness and agility is due to the animal having to range far and wide to pick up his living, and having to do work much more frequently than the European ox. Although in many parts of the world cattle are commonly worked, India yields to none in the value of her draught breeds, as England yields to none in her rich beeves. Thus we arrive at an important axiom as regards cattle-breeding in India, that *for working breeds we need not go outside of India for new blood though if we wish to breed for beef and milk, something may be done by crossing with English and foreign breeds.* This axiom is constantly to be held in remembrance, and neglect of it may lead to serious ill-consequences. (3) The fine full dewlap of Indian working cattle is supposed to at times attain such a degree of development as to interfere mechanically with the animals when trotting. This idea seems very widely accepted, and is received by Professor Wallace, but the evidence of its truth is doubtful and inconclusive.

The Zebu is a species which has undergone much modification, so that now there are numerous varieties or breeds. In the south of India the most important breed is the Mysori, which attains its highest development in the Hallikar variety of the celebrated Amrut-Mahal bullock of Hoonsoor. These are excellent animals for fast draught, being quick and light in action, plucky and enduring; they are generally steel grey or white in colour, with an intelligent expression, long straight sharp horns inclining upwards and backwards, and often running parallel from swollen longitudinal ridges on the forehead. They are not very large, although bullocks of this breed of considerable size are sometimes seen. Besides the three varieties of the Amrut-Mahal, Hallikar, Hagalwadi, and Chitaldroog, there are a number of sub-breeds of local varieties of Mysoris, for example the Madesvaram Betta of large size, and the Kankanhalli of small size. In the Punganoor zemindari of North Arcot good cattle of the Mysore stamp, but small, are bred. The influence of the Mysore breed extends northwards to Bombay on the Western Coast, and to beyond Secunderabad in the Nizam's Dominions, but an intermingling with other breeds occurs rather extensively, and in some of the countries of the south, as also along the Kistná, Kaveri, and Godaveri Valleys, and in the Southern Maharatta Country, the country cattle almost attain the importance of distinct breeds on account of their size, strength, and special shapes. On the Coast, too, is found a small breed of beautifully agile cattle used for very light and fast draught. Wallace, with his usual zeal for creating breeds, terms them Diminutiva. But, even if it were for a moment accepted that they were a distinct race, some more suitable name could be found than that.

The first serious competition northwards that the Mysoris meet is from the bullocks of Ongole or Nellore. These have short sharp horns, long pendulous ears, large dewlap, massive frame, and large size. They are grand looking animals, very useful for slow work but not specially active. The cows are good milkers. Animals of this variety are good-tempered and tractable. The sterling qualities of these cattle have secured them a very wide range, which, however, seems to be gradually becoming restricted. They are found in the Hyderabad Contingent Artillery, and as gun bullocks are most imposing in appearance, but slow. In the Cuddapah and Bellary districts they are used extensively under the plough. The breed has been tried up at Hissar, but is not a favourite there; still it is doubtful if it is well represented by the bulls brought north as typical, and the same remark applies to Mysoris. Time will not permit further notice of Madras cattle; though the Salem breed, Trichengode milkers, and the Kangayen variety (the Coimbatore), are deserving of mention.

In the Bombay Presidency the Guzeratis first demand consideration. They are large, slow, good-tempered, noble in appearance, and good workers in plough or along country roads. Their form of horn is characteristic and regular, the twist is outwards then upwards, and having a final turn at the tip, and for their medium length the horns are stout. They are justly considered by Wallace to be "decidedly the finest of all large cattle of the North-West of India, and only equalled by the Kistna bullocks of the South." Nariad may be taken as the centre of the breed. Cattle of this kind are constantly seen in the Bombay streets in large carts, but they are slow in the extreme, are considered too soft of foot for street work, and rather more frequently unsound than the Mysore or local country breed. This is a serious matter which ought to be carefully looked into by cattle breeders. The idea may be erroneous, but there is somewhat a general impression that the breed is degenerating. The influence of the Guzeratis extends into Kathiawar, northwards into Rajputana, and eastwards to the Ghauts. Outlying sub-breeds are the Kankreji and Malwi, the former occurring on the N.-E. of Guzerat, the latter in the Satpuras. I observe that the Mhow Heavy Field Battery bullocks are recorded as principally Malwis. In Kathiawar the most characteristic animals are the Gir or Junagadh, which have secured such a reputation for milk-producing powers, that they are the principal milch cattle of Western India. They are sometimes called Suratis, but were originally brought from Kathiawar, and Wallace has recorded a tradition that even thither they were imported from the West. He details arguments in support of this view, which seems feasible, for certainly in shape of front and horns the Kathiawaris are remarkably different from other Indian cattle. In Sind is a good breed of working cattle, short-horned, and generally of a white colour; the cows are said to be good milkers; the bullocks are good-tempered, but slow in work.

In some part of the Bombay Presidency the cattle have attained a fair amount of definiteness of breed, although as varieties they are not so well-known as the Guzerati. Thus the Dangis or Hill breed seen near Igatpuri, and the well-bred race of cattle developed at

Bhadgaon, by the efforts of Stormont, ably seconded by Mr. P. R. Mehta are worthy of mention. Wallace notices the Deccani, as a distinct breed, but hardly is very successful in defining it. Where cattle are well cared for and richly fed on kurbi and grain throughout the year, they become large and strong. The Berars and certain parts of the Central Provinces thus show us beasts of a most excellent stamp. On the other hand, wherever in the hills and elsewhere cattle are left to pick up their own living as best they may, to starve all summer, and where they breed promiscuously, the race becomes stunted and degenerated.

Northwards through Marwar the Guzerati gradually become merged in the cattle of the Punjab, especially the species of Wagad, Nagar, or Hissar race, which has its centre at the celebrated Hissar Government Farm. At the farm a number of crosses are found, but there is a large, long-horned, strong bullock which has specially resulted from the efforts of this establishment and is much used for army purposes in Upper India. These bullocks are excellent for cart purposes, being docile, powerful, and of fair speed. They look rather leggy, however; and it is open to question whether for military purposes they equal the Mysori, certainly the latter, for breeding, pluck, speed, and endurance ought to take the first place among Indian cattle, but his smaller size and less weight render him less suitable for very heavy draught than either Nellore, Guzerat, or Hissar bullocks. The cows in and about Hissar, known as the Hansi breed, have attained much importance in North India as milkers. Mainly through the efforts of Syed Mahomed Hussein some of the local breeds of the N.-W. Provinces and Oudh have attained a place in Wallace's book, the Gorannea of Bundelkund and the Bagondha of Oudh are thus entered as distinct breeds, but are probably mere local sub-varieties. The Santhal cattle from the Barakur River, the Purbi or local Allahabad breed, and the small neat cattle seen near Jessore (which Wallace considers very like Channel Island stock) are rightly considered purely local. The bullocks of Burma are stout, thickset, short-horned, and excellent for cart work. Those of Ceylon are described as small, light in build, neat in appearance, and remarkably like Adens. These latter are neat, well-bred, short-horned or polled, symmetrical, and they are constantly imported into India, because of the excellent milking qualities of the cow.

Such is a hasty review of the cattle of India. The general impression one will gain from this summary is, perhaps, that India is remarkably well-off for cattle, whether for slow draught, fast work, or milking purposes. Such is certainly the case. Possibly some good in the future may be effected by crossing the Indian breeds more frequently than now, but it seems evident that if any gain whatsoever resulted from import of working cattle, say from Italy or the south of France, this would be more than counteracted by loss of stamina and of suitability to the climate on the part of the Indo-European progeny. As regards milk, the Short-horn cross would certainly increase the yield and quality, but the resulting animals would need great care, and could only thrive in cooler parts of the country. With Kathiawar, Sind, Hansi, Nellore, and Aden cows we need hardly resort to Europe for milking breeds. As regards beef, Indian cattle are, undoubtedly, very inferior, but as the demand is very limited it would probably be fully met by the Commissariat establishing a central beef farm, and distributing bullocks for slaughter to the large stations within range. It would not cost much to attach an English beef herd to each of the existing public cattle farms, and the herds might possibly be made self-supporting. In such a country as India, however, improved beef can hardly be considered a crying necessity, as the beef-eating population is in such a large minority.

Another point which is conspicuous in description of Indian cattle is the absence of well marked differences sufficient for popular description. The points by which the general varieties can be distinguished from one another are simply those of differences in size and shape which it requires a practised eye to detect, although at a glance in the case of any special animal it is possible for an experienced man to form a correct idea of his breed. This is strongly confirmatory of the view that the zebu is a true species, and has diverged far in the line of development from the ox of Europe. Whether, or no, he is a black race is a point which has been raised by Professor Wallace, but which we will not now discuss, for it is at present *sub judice.*

In the study of Indian cattle crop up numbers of questions of the utmost practical and theoretical importance into which I must not enter here, but must ask you when you read in the newspapers about traffic in hides, horns, bones, and hoofs, or concerning live stock sales, the great fodder question, vaccination of cattle, inspection of dairies, improvement of stock, cruelty to cart bullocks, cattle poisoning, ghee adulteration, meat markets, and murrains to take these notices as evidences of the great part Indian cattle have in the welfare of this grand and progressive country.

CORRESPONDENCE.

THE *ECHIS CARINATA* AND ITS ALLEGED ANTIDOTE.

Sir,—The appalling statistics of the mortality from the bite of the above snake, brought to notice by Mr. G. W. Vidal, C. S., at the recent meeting of the Bombay Natural History Society, make one shudder. It is to be hoped that Mr. Vidal will continue his interesting narrative, and let us have some authentic information on the supposed antidote discovered by a medical officer at the above civil station. In the interim please allow me to say a few words anent the "bite of the *echis carinata* and the antidote."

The bite from the *echis* (*phursa* or *kapar*) produces peculiar symptoms to any other of the ophidian *venenose* family; its *virus* liquefies, while the others coagulate the blood. Besides, a severe bite from an *echis* causes excessive hæmorrhage from the part bitten, from the gums, and from any eruption that may be on the body. Death ensues from continuous bleeding, and, I am told, is accelerated when ammonia is administered. Of course, I am open to correction.

Mr. Vidal, C. S., is doubtless aware that there exists a shrub—*Pogostemon purpuricaulis*—on the Western Ghats and at Poona, the root of which, if masticated, and also if applied to the punctured part like a plaster, it will almost instantly allay the hæmorrhage, in fact, I have learnt, it acts like a styptical charm, but only in case of the *echis*? Has the root been tried, if so, what has been the result? I have not seen Dr. Dymock's book on Indian Botany; perhaps the properties of this apparently valuable medical plant has been fully noticed by him. Mr. G. Carstensen, of the Victoria Gardens, will be able to further enlighten us most probably?

The *Pogostemon purpuricaulis*—after a great deal of trouble (qv. *Asian*, 29th October last)—I find to have a number of *aliases* or pet names, so commonly given now-a-days by our modern botanists. Since Drury and Birdwood's (Vegetable Products) and Loudon mention nothing about this shrub, I communicated (through the *Asian*) to "Smoothbore," and am indebted to him for the following synonyms :—

Pogostemon purpuricaulis	Dalz. in Hook.
Do. purpuricale	Drury, Indian Flora, Vol. II., p. 59.
Do. parviflorus	Benth. in Wall.
Do. pubescens	Benth. in D. C. L.
Do. fontescras......................	Graham's Cat., Bombay, pl. 149.
Do. intermedius	Wall Cat. 2327.
Pangla	Bombay Pres.

The Secretary of the "Botanical Section, Bombay Natural History Society," I hope, will be good enough to analyse the *root* of this plant, which it is supposed to be a styptical agent, and let the members know if the alleged antidote has been proved to be efficacious in the bite of the *Echis carinata*, known to Anglo-Indians as the deadly "carpet snake."[*] I came to know of this plant by a friend wishing to know "What root of a shrub has styptical properties for the *echis*?"

The shrub is about five feet high, with leaves about eight inches long and velvety back; the bark is sometimes of a dark purple hue, emitting when crushed a black currant-like odour,—Yours, &c.,

N.-W. P. Jan. 20. F. R.

Sir,—As "F. R." rightly supposes, in his letter published in your issue of the 25th January, I am well aware of the existence of the shrub (*Pogostemon purpuricaulis*), and of its empirical use in cases of echis bite. In the course of the last ten years or so, I have on more than one occasion tried to direct attention to this shrub, and to stimulate further inquiry as to its supposed value as a styptic. In particular I may refer "F. R."—as he has apparently not seen it—to a note contributed to the *Asian*, I think in 1881, but haven't the files to refer to here—in which I gave all the information then available on the subject.

As far as I know, nothing further has since been elicited. I am glad, however, to see that attention has again been drawn to the matter.

The use of the root of this plant to stop the hæmorrhage, which is the most troublesome and dangerous symptom of echis bite was, if I remember right, first brought to light when Mr. J. Elphinston was Collector of Ratnagiri, about 1873 or 1874. A clerk in the Collector's office was bitten by an echis, and a Brahman, who was called in to treat the patient, produced some root, from which he prepared a paste for external, and a decoction for internal, application. This treatment was so successful in stopping the bleeding, that Mr. Elphinston made inquiries about the root. After some show of reluctance the Brahman was induced to point out the shrub from which it was obtained. The shrub turned out to be a very common one, locally called "Pangla," and some years afterwards I procured specimens which established its identity with *Pogostemon purpuricaulis.*

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[*] The popular name of *Carpet Snake* is used by Anglo-Indians in the most careless manner, and is generally applied to the Daboia.—Ed.

A supply of the root was obtained by Mr. Elphinston, and sent to the Ratnagiri Civil Hospital, where its value was practically tested by Dr. Christopher Joynt, then Civil Surgeon. Dr. Joynt himself treated several cases of echis bite with it, with good results, *post hoc* or *propter hoc,* as the case may have been. Subsequently—about 1880, I think—he contributed a paper, giving the results of his experiments, to the Bombay Medical and Physical Society. *Most unfortunately,* this Society had temporarily stopped the publication of its journals just about the time when Dr. Joynt's paper was received, and as I ascertained afterwards from Dr. Joynt, the original paper had either been lost or mislaid, while he himself had kept no copy of it, and had moreover destroyed, or lost the notes from which he wrote it. I understood from him, however, that he was pretty confidently of opinion that the root really possessed valuable properties as a styptic.

I am not aware if any further trials of the root have since been made at Ratnagiri, or elsewhere. Some years ago I remember sending pieces of the root to Mr. A. Bettington (late Bombay C. S.), who was interested in the matter, and wished to have the root chemically analysed. But the analysis, if any was made, revealed nothing useful.

The plant is not included in the Indian Pharmacopœia. If, as there is some reason to believe, it has the property ascribed to it, it would be a very useful addition. This, however, is a question for doctors rather than naturalists, to take up.

The shrub is called "Pangla" I believe, only in the Konkan. Above the Ghats, in Poona, Nasik, &c., it is known as "Fangal." It grows very abundantly on both sides of the Sahyadri watershed, where the rainfall is sufficiently heavy; and as "F. R." observes, its strong black currant smell is a distinctive feature. I may add that it is largely consumed about Egtnpura for *rab,* that is for burning on the seed beds prepared for rice and other cultivation.

Lastly, to refer to another point noted by "F. R.," ammonia has been declared by a former medical officer at Ratnagiri, who had a large experience of cases of echis bites to aggravate rather than otherwise all the worst symptoms. The bite of this viper is apparently fatal in about 20 per cent. of cases, and the action of the poison is slow. In collecting materials for an account of the snakes of Ratnagiri for the *Bombay Gazetteer,* I found (in 1878) records of 62 fatal cases treated at the civil hospital. These cases showed that death occurred on an average in four and a half days, though in some instances patients had lingered up to twenty days.—Yours, &c.,

G. VIDAL.

Camp Gokhantar, Northern Frontier Line, January 30.

[The above letters appeared in the *Bombay Gazette.*—Ed.]

THE *ECHIS CARINATA* AND ITS DESTRUCTION.

To the Editor, "Bombay Natural History Society."

Dear Sir,—I have read with much interest Mr. Vidal's paper on "Mortality from Snakes in the Bombay Presidency." He makes special reference to the snake called "Phursa" in the Ratnagiri district. It may interest you to hear some facts which came to my notice when Collector of Ratnagiri.

Below Ratnagiri lies the large taluka of Deogad, which extends from the sea to the line of ghâts. It comprises many miles of waste rocky country, and here more especially it is that the Phursa breeds. I made particular enquiry and ascertained that in April, May and June the young are born, but they are difficult to find. Although I offered a reward of half an anna per Phursa in these early months, no one would take the trouble to look for them. In August and September the Mhars go out with long sticks, to which forks are attached, and catch them in thousands, bringing them into Deogad in baskets, and exhibiting them at the Mamla kacheri, where three pies Government reward is paid for each Phursa, whose head is then cut off to prevent any roguery on the part of the natives. I cannot say for how many months longer the Mhars would or could have gone on catching these Phursas, for the funds placed at my disposal always came to an end before the close of November.

I remember once being in a predicament on this account. I was encamped at Deogad, and found the Kacheri surrounded by angry Mhars demanding the Government reward, and insisting on placing before me baskets of defunct Phursas which smelt strongly. My funds being exhausted, I, of course, failed to satisfy them. I took the precaution to advise the Mamlatdar to go home warily with a lantern lest out of revenge they might strew his path with still living Phursas.

The rate of mortality is small when we consider that from two to three lakhs of snakes are killed during only four months in the year, and that for the remaining eight months the Phursas are unmolested. This may account for the fact that the Phursas in this district do not decrease, and that the figure of death-rate from snake bites differs but little from year to year. As a matter of fact there is but little necessity for people to go into the jungles where the Phursas are mostly to be found, otherwise we should certainly hear of many more deaths. If I remember aright, I never had more than Rs. 3,000 a year placed at my disposal for the whole district as rewards both for slaughter of wild animals and of snakes, and I could very easily have spent double this sum in the Deogad taluka alone. If our Society takes up the question and places in a clear light the necessity for exterminating the Phursa, it might be urged upon Government to spare Rs. 5,000 for the purpose, or some philanthropic person might advance the money as a work of *Dharm*. The measures taken should be systematic and thorough, under reliable supervision, and the work of extermination should last from August to February at least. It will then be a matter of wonder how many thousands of Phursas meet their death.—I am, &c.,

R. E. CANDY, C. S.

Sholapur, January 1890.

MISCELLANEOUS.

BRANCHING TREE FERNS.

In the Journal of the Bombay Natural History Society, Vol. iii, p. 250 (1888), Mrs. W. E. Hart contributes a valuable note on some Branching Palms. Is it generally known that Tree-ferns are also branched occasionally and in a similar manner? Last October I spent an hour at least during a beat for deer under the trunk of a large Tree-fern on the Rungneet Tea Estate below Darjiling, at about 5,000 feet elevation above the sea, the fern being about 30 feet in height and bifurcated at about 6 feet from the top, the two bifurcations being of equal size and height and lying very close together, and each bearing a perfect crown of fronds. I am informed by a lady resident of Darjiling that there is another bifurcated Tree-fern on the Tukvar Tea Estate, and still a third on the road down to Tukvar from Darjiling, so that abnormal examples appear to be by no means rare in the Darjiling district, though the one briefly described above is the only one seen by me.

LIONEL DE NICEVILLE, F.E.S., C.M.Z.S., &c.

1st *February* 1890.

SNIPE SITTING IN THE OPEN.

Rowing down the Nageshwari River to-day, I was a little puzzled by a group of birds gathered about two scanty tussocks of about half-a-dozen rushes apiece growing on an otherwise bare gravel-bank.

I fired into them and picked up three "full" snipe (not jacks or pintails), and a fourth ran into some long grass a dozen yards away, and was not bagged.

A little lower down a fifth was put up from a similar place.

The same thing once happened to me in Gujarat; the four snipe sitting on close-cropped grass sward beside a tank at Harsol; and several pairs and single birds on equally exposed turf all round the tank.

I have seen other instances, less noticeable, in India, but never at home.

Camp Dasgaum, 17*th January* 1890. W. F. SINCLAIR.

NOTE ON LOCUSTS IN INDIA.*

The presence this year of swarms of locusts in part of Sind, Gujarat, Rajputana and the Punjab, affords an opportunity of elucidating several of the points which are at present doubtful in the history of these destructive creatures. The following short account is therefore given of what is known on the subject, in the hope that some of those who read it will assist in obtaining further information and specimens, so as to enable a complete account to be drawn up for publication, in the report which is being prepared under the direction of the Trustees of the Indian Museum, in connection with the general investigation of Economic Entomology which has been undertaken.

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* This note is compiled from a large series of reports, chiefly from those contained in the Records of the Revenue and Agricultural Department of the Government of India. These sources of information will be fully quoted in the general report which is in preparation; in the present note, therefore, though the actual words of the original writers have often been used, it has been thought best not to give references which would necessarily be extensive. It should be noticed, however, that in the case of the Bombay invasion of 1882-83 the excellent reports of Mr. J. Nugent have been almost exclusively used.

In the case of the locust of North-Western India, what are chiefly wanted are: (1) authentic specimens taken in various places both of this year's locusts and also of locusts which have proved destructive in former years, so that the identity and distribution of the species may be definitely settled; (2) information as to the permanent breeding-grounds from which the locusts come, and also as to the number of broods and the production of a second generation, when breeding takes place in the plains. Similar specimens and information will also be welcome in the case of locusts which have at different times invaded other parts of India.

Locusts can be at once killed and preserved by dropping them alive into a bottle of strong alcohol (*e.g.*, whisky) in which they will travel quite safely if care is taken to fill the bottle so as to prevent jarring.

Locusts appear from time to time over wide areas in North-Western, Western, and Southern India, besides isolated flights which occasionally appear in the western parts of Lower Bengal and in Assam. Records have been found of a number of such invasions, many of them responsible for very serious damage. Of these, the best known are the locust invasions of 1869 in Rajputana and the Punjab, of 1878 in the Madras Presidency, and of 1882-83 in the Deccan. It is to these three invasions then that we must chiefly direct our attention for an understanding of the subject.

The general received idea is that the locust which invades India belongs to the species which is generally spoken of as *Acridium peregrinum,* and which is supposed to have been the *locust* of the Bible. *Acridium peregrinum* is undoubtedly the locust which in past years has periodically done great injury to crops in Algeria, though recently a very different species has appeared there. The identity, however, of Indian locusts has not as yet been by any means definitely ascertained, and this is one of the points which require elucidation; as far, however, as we at present know there seems reason to believe that while *Acridium peregrinum* extends its ravages into the dry plains of the Punjab and Rajputana, the locust which proved injurious in Madras in 1878, and in the Deccan in 1882-83, belongs to a very different species, which is probably *Acridium succinctum.* In order, however, to settle the question, it will be necessary to examine further specimens taken from destructive flights, which have appeared in various localities, the material in the Indian Museum being at present insufficient.

With regard to the natural history of locusts generally, we may observe that all the different species which occur in various parts of the world, breed permanently in barren elevated tracts where the vegetation is sparse. In years when they increase inordinately they descend in flights from their permanent breeding-grounds upon cultivated districts where they destroy the crops, lay their eggs, and maintain themselves through one complete generation, but are unable to establish themselves permanently, usually disappearing in the year following the invasion, to be succeeded, after an interval of years, by fresh swarms from the permanent breeding-ground.

Generally speaking, the life circle of a locust extends through one year, in which period it passes through its various stages of egg, young wingless larva, active pupa and winged locusts, which dies after laying the eggs that are to produce the next generation. The eggs are laid in little agglutinated masses in holes, which the female bores with her ovipositor in the ground. In temperate climates the eggs are usually deposited in the autumn, but in sub-tropical countries, such as India, where there is but little winter, the winged locusts live on through the cold season and only die off after depositing their eggs in the following spring. In this case the eggs hatch after lying in the ground for about a month. In both temperate and sub-tropical regions alike the young wingless locusts, on emerging from the eggs in the spring or summer, feed voraciously and grow rapidly for two or three months, during which period they moult at intervals, finally developing wings and becoming adult. The adult insects fly about in swarms, which settle from time to time and devour the crops. The damage done by locusts is thus occasioned in the first instance by the young wingless insects, and afterwards by the winged individuals into which the young transform after a couple of months of steady feeding.

In Rajputana and the Punjab in 1869 the flights were said to have come chiefly from the vast tract of sand hills (*Teeburs*) between the Runn of Kutch and Bhawulpore, and partly from the Suliman Range in Afghanistan. Locusts were reported as usually to be found in the autumn in the *Teeburs*, and it would, therefore, appear probable that this tract is a permanent breeding ground, the supposition put forward in some of the reports, that the locusts had flown across from Africa being altogether improbable. On *á priori* grounds it to be expected that the chief permanent breeding-ground of the flight that invade Sind and Rajputana will be found to be the highlands of Biluchistan, or even further to the eastward. The whole question, however, of the permanent breeding-grounds of these locusts is one that requires further investigation. The winged flights appeared throughout Central Rajputana in the latter part of the hot weather, and laid eggs which hatched as the rains set in ; the old locusts dying after they had deposited their eggs. From these eggs were hatched young locusts which became full grown and acquired wings in August and September.

They were said to have laid eggs which produced a second generation in September ; but this appears improbable, as locusts in other parts of the world pass through but one generation in the year, though in some cases they produce more than one brood of young. One observer reported that he had seen eggs hatched as early as March in the Punjab, and this increases the confusion. The whole question therefore of the breeding habits of these locusts requires further investigation.

The eggs laid by the original flights at the end of the hot weather were distributed throughout the whole of Central Rajputana, and a vast amount of injury was done in Marwar, Ajmere, Kishengurh, Tonk, Sirohi, and the northern part of Meywar, the crops being damaged, in the first instance, by the young locusts before they acquired wings, and afterwards by the winged swarms which flew about the country and settled at intervals to eat what had escaped the ravages of the young wingless locusts.

In the Punjab, flights of locusts from the Suliman Range (Afghanistan), appeared in the western border (Dehra Ismail Khan) in the end of April and in May. Eggs and young locusts were also found about this time near the hills in the sandy tracts of the same district. The flights seem generally to have moved from west to east, and by July to have spread themselves throughout the Punjab (Multan, Amritsar, Sirsa, Ludhiana, &c.); but the laying of eggs and the hatching out of young went on, at least in the south-east (Sirsa, Hissar, Delhi) throughout August and September.

In Bombay, locusts were noticed in May and June 1882 in the south-west of the Presidency (Dharwar and Kanara Collectorates); but they attracted little attention, such swarms being annual visitors of the Kanarese forests, and neither in Kanara nor in Dharwar did they cause any material injury. With the setting in of the south-west monsoon, however, they spread in flights over the Presidency to the north and north-east (Satara, Poona, Nasik, Amednagar, and Khandesh), and early in the rains proceeded to lay their eggs and die. These eggs hatched in the end of July and beginning of August, and the young locusts did a large amount of damage over a wide area, through the months of August and September. In the early part of October, with the setting in of the north-east monsoon, the young locusts which had by this time acquired wings, took flight, and travelled with the prevailing wind in a south-westerly direction, doing some injury in the Poona Collectorate as they passed. They then struck the Western Gháts and spread slowly over the Konkan in November, and thence travelled into the native States of Sawantvadi and the Kanara district. During the remainder of the cold season and the following hot weather (December 1882 to the end May 1883), the flights clung to the Ghauts, occasionally venturing inland into Belgaum, Dharwar, the Kolhapur State and Satara, and devouring the spring crops in the Coast Districts; but ordinarily keeping in the vicinity of the hill ranges. With the commencement of the south-west monsoon, however (in the latter part of May 1883), the flights began to move in a north-easterly direction, as they had done the preceding year, but in larger numbers.

At the commencement of the rains they began to alight in vast numbers over an immense tract of country, comprising the six Deccan Collectorates of Sholapur, Poona, Khandesh, Ahmednagar, Satara, and Nasik, and also in the three Coast Collectorates of Ratnagiri, Kolaba, and Thana. They deposited their eggs and died, and early in August the young locusts hatched out in countless numbers, but were apparently more backward, and possessed of less strength and stamina than were those of the previous year. The unusually heavy rainfall killed vast numbers of them, in some parts of the country, and elsewhere the insects seemed stunted and feeble, and grew but slowly. They were destroyed in vast numbers by the vigorous measures initiated by Government officers, and were also said to be diseased and attacked by worms and other parasites. As late as November, the mass of the young locusts appeared still unable to fly and made no general move, as they had done the year before, towards their permanent home in the south-west. The invasion was in fact at an end, and though swarms appeared in Sawantwadi in 1883-84, no further injury of a serious nature seems to have occurred.

The injury occasioned to the rain crops by the locusts was very considerable over a great portion of the Deccan and Konkan, both in 1882 and 1883. But it was found, at the end of the invasion, that abundance of the cold weather crops had compensated to so great an extent for the injury done to the rain crops that, on the whole, no very widespread suffering had arisen.

In 1878, when the Madras Presidency was invaded, the young locusts began to appear in January, and were found in great numbers in different districts from then on until September and October, the earlier swarms being found in the west and south of the Presidency, and the later ones in the north and east. Winged locusts were first observed in the end of March and beginning of April, in the hills to the south-west (Wynaad and Nilgiri), where they may be supposed to breed permanently. Thence, aided by the south-west monsoon, they gradually worked their way over the Presidency to the east and north, finally disappearing about November and December. The information available hardly justifies any very decided conclusion as to the life history of the locust. But it may be noticed that locusts were observed pairing in the Salem District, in the latter part of June, and also that the young locusts, which were found in the early part of May, in the Udamalpet *Taluk*, were supposed to be the offspring of the large flights of winged locusts which had appeared in the preceding February in the some *taluk*. The connection between the autumn broods of locusts and those which appeared in the early part of the year has not been made out satisfactorily.

Remedies.—The following is a short account of the chief measures which have at different times been adopted in India against locusts. In this connection it must be remembered that the locust of N.-W. India being distinct from that of S.-W. India, the measures found useful in one invasion will not necessarily be applicable in another.

In the locust invasion of the Punjab in 1863, it was found that the only stage in which the pest could be successfully destroyed was while the eggs were still in the ground, or very shortly after the young had hatched. For the destruction of the eggs repeated ploughing was recommended, where practicable; while it was found that the young locusts, when only a few days old, could easily be destroyed by driving them gently into a small ditch, previously dug for their reception, and then covered with earth well pressed down. When not above a week old, a trench of six or eight inches wide and deep, such as two men could form in a few minutes, sufficed for securing the insects which jumped into it with alacrity, and appeared wholly unable to extricate themselves. In some districts eggs were purchased by weight and destroyed; but, as a general rule, it was not considered advisable that the labours of the population in destroying the pest should be remunerated by the Government.

In 1869, in the Punjab, the destruction of eggs was discouraged, as being a difficult operation and by no means certainly successful; while the destruction of the young, when first hatched by driving them into trenches, was found to be an exceedingly simple operation and certain and effectual in its results.

No general account has been found of the measures taken in Rajputana in 1869; but at least in one case, excellent results were obtained by digging a series of trenches in front of an advancing swarm of young wingless locusts; the earth being thrown up on the side away from the swarm, and each trench filled in as it became three parts full of the insects, which, like the locusts of Cyprus, were found to continue to advance despite the annihilation which resulted from their obstinacy in doing so. This makes it appear probable that the screen system which has been successfully used upon a large scale both in Cyprus and Algeria, against two distinct species of locusts, may be found applicable to the locust of Rajputana; though it has been shown to be quite useless against the locust which invaded the Deccan in 1882-83, and which declined to advance into the traps.

The Cyprus screen system consists of a series of cloth screens, from 2 to 3 feet high, bound along the upper edge with a strip of oil cloth to prevent the locust from climbing over; a long line of these screens is erected in front of an advancing swarm of young wingless locusts, so as to form an impassable barrier for them; pits are dug at intervals, close to the screens and at right angles to them, on the side towards the advancing swarm. The edges of the pits are guarded by frames, made of cloth and wood, with overhanging zinc edges, arranged to prevent the escape of the locusts from the pits. The swarms were found, both in Cyprus and Algeria, on arriving at the screen, to turn to the right and left along it, apparently endeavouring to go round it, the locusts thus poured in countless numbers into the pits, and being unable to escape, could be destroyed wholesale.

Of the measures adopted in the Madras Presidency in 1878, the most successful seem to have been the destruction of the swarms of young wingless locusts by driving them into lines of burning straw; the preventing the flights of winged locusts from settling in the fields, by lighting fires, beating drums, and waving branches and clothes in the air, as soon as a flight appeared; and the driving of the winged locusts out of the fields, when they had already alighted, by beating through the crops. It is said that in cases where winged flights were driven persistently through a number of villages, without being allowed to settle, the locusts perished without doing injury.

In the Bombay Presidency in 1882-83, various methods were employed on a large scale to destroy the locusts, which were to a great extent kept under by the energetic measures taken against them. The Cyprus screen system, described above, was found utterly inapplicable, and had to be abandoned. A plan was devised of forming lines of beaters armed with fan-shaped besoms of twigs, so close together that locusts could not escape between them, and marching the beaters from end to end of the field, vigorously beating the grass or crop in front with a view to crush the young locusts. The plan was successful to some extent in short grass, but it was evidently destructive to the growing crops and could not be tried on them. The plan of dragging rapidly, for ten or twelve yards, country blankets or *dhotars* along the surface of the field where locusts lay, and then squeezing up the cloth to kill the locusts contained in it, was found useful in thick bushy tracts, but required, for its successful working, a good deal of activity and intelligence. The most successful method employed was the bag net system, which consisted of a capacious bag, much like a huge bolster case, but open at the side instead of at the end, and five or six feet deep by eight or ten feet long. This was held by two men, one at each end. The open side of the bag net was run along over the grass or young crops, and as the young locusts tumbled in, they could not get out again; when nearly full, the mouth was closed and the bag twisted up together so as to kill the locusts that had been caught. This was found to be a simple and easy means of destroying the locusts, and the people took to it readily all over the locusts-affected area. Little or no injury was done to the crops by the men working it, and millions of insects were killed.

E. C. COTES,
Indian Museum, Calcutta.

The 6th November 1889.

PROCEEDINGS.

PROCEEDINGS OF THE DECEMBER MEETING.

The usual monthly meeting of the Members of this Society took place on Thursday, the 5th December 1889, Dr. D. MacDonald presiding.

The following new Members were elected :—Dewan Bahadur Luxumanrao Jugonnath Vaidya, Mr. Vundravandas Purshotumdas, Mr. R. H. E. Thompson, Dr. H. S. G. Jayakar, Col. H. Powlett, Mr. H. J. P. Hargrave, M.I.C.E., and Dr. H. E. Drake-Brockman, F.Z.S.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions to the Society's collections, *viz.* :—

CONTRIBUTIONS DURING NOVEMBER.

Contributions.	Description.	Contributors.
2 Martens	From the Himalayas	Mr. J. C. Anderson.
2 Owls (alive)	Strix javanica	Mr. S. W. Chart.
A quantity of fresh-water fish, &c.	From Raipore, C.P.............	Mr. J. A. Betham.
A number of butterflies, snakes, and lizards.	From Simla	Mr. A. Newnham.
2 Porpoises (alive)	Neomeris karachiensis	Mr. W. F. Sinclair, C.S.
1 Snake (alive)	Zamenis diadema	Mr. D. Wilson.
1 Dhaman (alive).............	Ptyas mucosus	Mr. Smith.
2 Large wasps' nests	From Tansa.................... .	Mr. Shivlal Motiram, Khan Saheb.
1 Python (alive)	Python molurus	Mr. E. L. Barton.

MINOR CONTRIBUTIONS.

Mr. E. A. Corke, Lieut. J. Devine, Miss M. Bapty, and Mr. Framjee N. Davur.

CONTRIBUTIONS TO THE LIBRARY.

The Ethiopian and Oriental Representatives of the Mantidean Sub-family Vatidæ; by J. Wood-Mason, presented by the Author.

Buffon's Natural History, Vols. I. and II., presented by Mr. W. C. Rowe.

A Monograph of Oriental Cicadidæ (W. L. Distant), presented by the Indian Museum.

Report on the Mineral Statistics of Victoria (Duncan Gillies), presented by the Author.

Notes on Indian Economic Entomology, presented by the Authors.

PRESENT TO THE SOCIETY.

The Honorary Secretary stated that Mr. C. B. Lynch had very generously presented to the Society the large oil painting of tigers by Mr. R. A. Sterndale, which he (Mr. Lynch) had recently purchased from the executors of the late Mr. W. J. Best.

A hearty vote of thanks was passed to Mr. Lynch for his munificent donation.

CHIN-LUSHAI EXPEDITION.

The Honorary Secretary also mentioned that Captain Chase, of the 28th Bombay Pioneers, had kindly volunteered to collect any specimens which he could obtain for this Society during the regiment's stay in the Chin-Lushai District.

A TRIP TO AUSTRALIA.

Dr. K. R. Kirtikar then read the first part of an interesting paper, entitled, "An Indian Naturalist"s Trip to Austialia," which was illustrated by the various botanical specimens, &c., which he had brought with him from Australia. The first part of this paper appears in the Society's Journal No. 3, Vol. 4, now being distributed amongst the members.

PROCEEDINGS OF THE JANUARY MEETING.

The usual monthly meeting of the members of this Society took place on Thursday, the 9th January 1890, when Dr. G. A. Maconachie presided.

The following new members were elected:—Mr. F. M. Flower, Colonel Kenneth Mackenzie, Mr. T. H. Middleton, Mr. J. Sladen, C.S., Mr. F. H. Tod.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions:—

CONTRIBUTIONS DURING DECEMBER.

Contributions.	Description.	Contributors.
1 Sea Cucumber	From Singapore	Mr. W. D. Graham.
1 Painted Bat	Kerivoula picta	Mr. G. Carroll.
1 Head of Nilghiri Wild Goat.	Capra hylocrius	Mr. E. L. Butcher.
1 Head of Hyæna	Pierced through lips, nose and both eyes with porcupine quills.	Mr. W. Home.
1 Owl (alive)	Strix javanica	Mrs. Hojel.
1 Smew (female)	Shot in Guzerat	Mr. E. Giles.
1 Orange Minivet	Pericrocrotus flammeus	Col. Kemble.
2 Eggs of Rock Horned Owl.	Bubo bengalensis	Do.
1 Koel	Endynamis honorata	Capt. T. Thorburn.
Two pieces of Rhinoceros' Skin.	Tanned in Cawnpore	Col. Baddeley.
1 Cobra	Naja tripudians	Dr. Weir.
2 Silver Pheasants (alive).	From China	Capt. Nantes.
1 Golden Pheasant (alive).		
1 Rail (alive)		
A quantity of Fossil Bones.	From the Gulf of Cambay	Mr. H. Grogan.
4 Jerboa Rats (alive)	From Bushire	Mr. Cook.
1 Antelope's head	Curiously deformed	Mr. F. Otto.
1 Owl (alive)	Strix javanica	Mr. J. Bristed.
1 Head of Hog-deer	Axis porcinus	Mr. H. C. V. Hunter.
1 Head of Swamp Deer	Rucervus duvancelli	Do.
A quantity of Snakes and Lizards.	From Carwar	Mr. E. H. Aitken.
2 Phoorsas	Echis carinata	Colonel Hore.
2 Jungle Cats (alive)	Felis chaus	Mrs. W. E. Hart.

A special vote of thanks was passed to Colonel Kenneth Mackenzie for his valuable contribution to the Society's Library, consisting of an interleaved copy of *Jerdon's Game Birds of India*, illustrated by means of photographs taken by General H. Watson.

EXHIBIT.

Mr. Thomas Drewet sent for exhibition a full-grown domestic cock with an abnormal leg, growing out at right angles to the others, under the tail.

The Zoological Collection at the Victoria Gardens.

Mr. Phipson drew the special attention of those present to the great improvements which were being carried out at the Victoria Gardens, and hoped that the members of the Natural History Society would assist Mr. Ollivant in his efforts to make the Zoological Collection a credit to the city. Open-air cages for the large carnivora were being built on a plan suggested by the Committee of the Natural History Society. One of these cages was now finished, and a pair of tigers would shortly be transferred to it. It would be seen that the cage in question consisted entirely of iron bars, on a stone plinth, and as it measured 40′ by 20′ the animals would have far more space for exercise than in ordinary cages. A new deer-park was being laid out, and a snake pit had been constructed. A supply of harmless snakes, such as pythons, dhamans, checkered water-snakes, &c., was now much wanted.

Mr. Phipson also stated that the Society had already sent the following contributions to the Victoria Gardens:—

3 Bears	*Ursus labiatus.*
4 Swans	*From England.*
2 Panther Cubs	*Felis pardus.*
7 Crocodiles	*Crocodilus palustris.*
1 Porcupine	*Hystrix leucura.*
1 Monkey	*Macacus radiatus.*
1 Monkey	*Macacus silenus.*
2 Grey Jungle Fowl	*Gallus sonnerati.*
1 Mongoose	*Herpestes griseus.*
1 Indian Palm Civet	*Viverra malaccensis.*
1 Malay Bear Cub	*Ursus malayanus.*
1 Purple Coot	*Porphyris poliocephelus.*
3 Tortoises	*Testudo elegans.*
1 Lesser Florican	*Syphcolides aurita.*
2 Toddy Cats	*Paradoxurus musanga.*
3 Snake Birds	*Plotus melanogaster.*
3 Owls	*Strix javanica.*
1 Slow Paced Loris	*Nycticebus tardigradus.*

The following papers were then read :—

Notes on a Caterpillar Farm, by Mrs. W. E. Hart; a List of the Venomous Snakes of North Kanara, by Mr. G. W. Vidal, C S.

PROCEEDINGS OF THE FEBRUARY MEETING.

The usual monthly meeting of the Members of this Society took place on Thursday last, 6th February 1890, Dr. D. Macdonald presiding.

The following new Members were elected:—Colonel J. Waterhouse, Mr. Fred. Wright, Col. C. F. Hughes, B.S.C.; Mr. P. E. Myer, Mr. Walter Lang, and Mrs. McLaren.

Mr. H. M. Phipson, the Honorary Secretary, acknowledged the following contributions :—

CONTRIBUTIONS DURING JANUARY.

Contributions.	Description.	Contributor.
1 Slow-paced Loris	Nycticabus tardigradus	Gen. C. D. LaTouche.
1 Snake	Simotes russelli	Mr C. E. Kane.
2 Civet Cat (alive)	Viverra malaccensis	Mr. Pereira.
2 Snakes	Lycodon aulicus, Echis carinata.	Mr. A. C. Walker.
A quantity of Birds, Insects, &c.	From Ceylon	Gen. C. D. LaTouche.
Head of Hornbill	Dechoceros cavatus	Mr. W. F. Sinclair, C.S.
Red-crested Wood-Quail.	Rollulus roulroul	Mr. Dady Maneckjee Limjee.

MINOR CONTRIBUTIONS.

Dr. Weir, Mr. J. Stiven, and Mr. I. Benjamin.

CONTRIBUTIONS TO THE LIBRARY.

	Presented by
Memoirs of the Geological Survey of India	In Exchange.
The Birds of India, Vol. I. (E W. Oates)	The Author.
Hume's Nests and Eggs of Indian Birds (2nd Edn.) (E. W. Oates).	The Author.
Verhandlungen der Zoologisch-botanischen Gesellschaft in Wein, XXXIX. Band III. IV. quartal.	In Exchange.
Physiological and Pathological Researches, by Dr. T. R. Lewis.	The Lewis Memorial Committee.
The Indian Forester, August, 89	In Exchange.
Classified List of the Plants in the Botanical Gardens, Péradeniya, Ceylon.	Purchased.

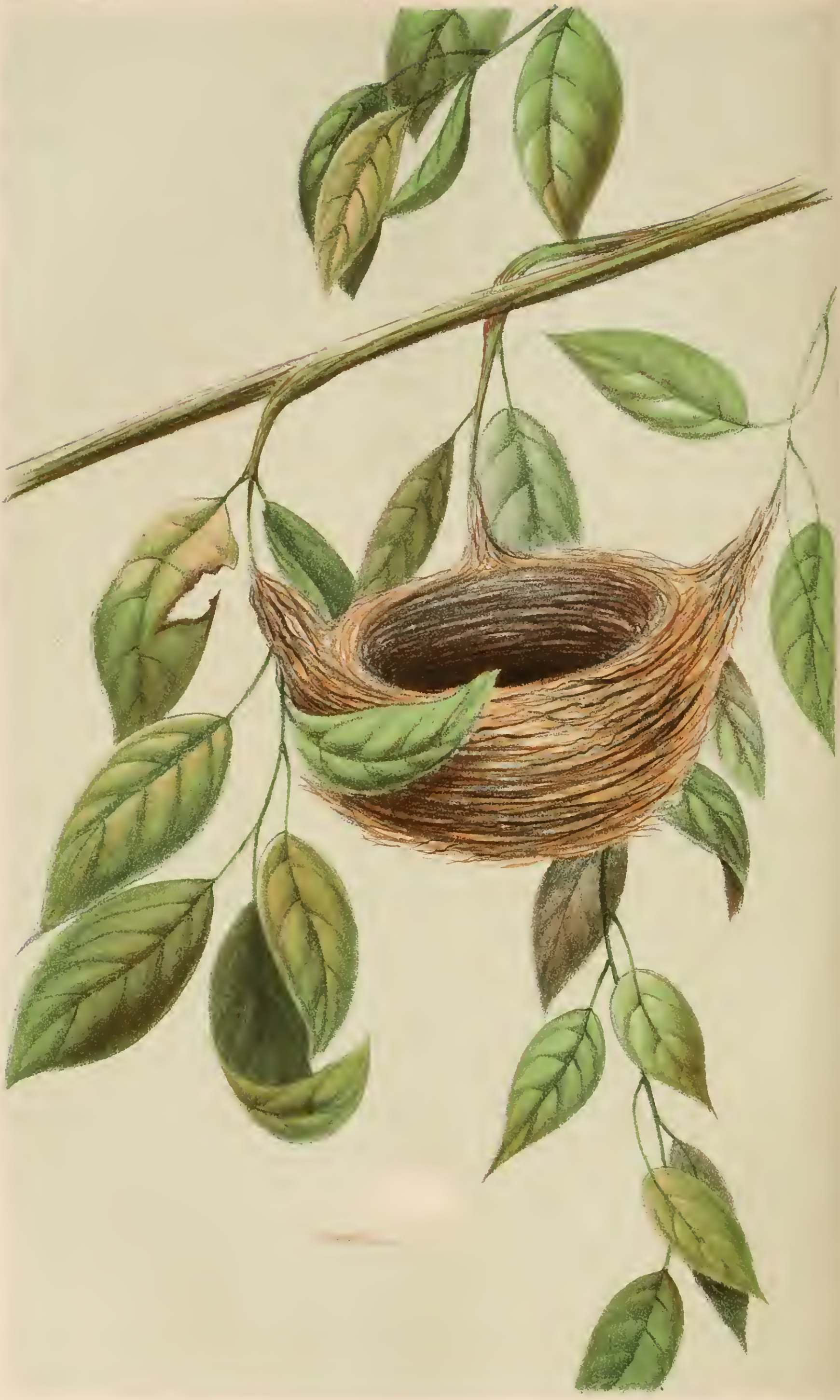
PHOTOGRAPH.

The Honorary Secretary drew the attention of the Members present to the photograph of an African Lioness, taken by Mr. J. D. Inverarity, and enlarged and presented to the Society by the Honorable Mr. Justice Parsons.

A NEW BUTTERFLY.

The Honorary Secretary read a description of a new morphid butterfly *Stichopthalma nurinissa*, n. sp., by Mr. L. de Nicéville, of Calcutta. The new butterfly, drawings of which were exhibited, differs from *S. Nourmahal* in its lighter coloration on the upper side and has been found in Bhutan.

Mr. J. H. Steel, A.V.D., F.Z.S., then read an interesting appear on "Indian Cattle," illustrating his remarks with specimens of skulls of the principal breeds of India.



H. B. del.

Mintern bros. Chromo lith. London

631. ZOSTEROPS PALPEBROSA, Tem.
The White-eyed Tit.

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NESTING IN WESTERN INDIA.

By Lieut. H. E. Barnes.

(Continued from page 19.)

631.—THE WHITE-EYED TIT.

Zosterops palpebrosa, Tem.

The White-eyed Tit is extremely rare in Sind, but occurs more or less commonly throughout the rest of the Presidency. In most places they are, I believe, permanent residents, but are often overlooked, as during the breeding season they are only found in well-wooded secluded nullahs; but in Poona, where they are very common, I have found nests in the middle of cantonments. The breeding season extends from the end of April to about the commencement of September, but June is the month in which most nests are found. I do not think that they have more than one brood in the season, as up to the first week in June nests are few and far between, but after this date they become very common, and I have found as many as twenty nests in a morning in a single nullah. After the second week in July, they again become rare, an occasional nest only being met with, and this probably belongs to a pair of birds whose first nest has been robbed.

Mr. Davidson differs from me in this. He says:—"Judging from the numerous empty nests one sees, from which young have been hatched, while others contain eggs, I think they must have two broods."

Guided only by my experience in Poona, I should feel inclined to agree with him in this conclusion, as there I found nests from April to September; but in Saugor, Central Provinces, the breeding season is much shorter: in fact, except during the last two weeks in June and the first two in July, only an occasional nest is found. This period is much too short for two broods.

The principal reason that induces birds to breed at one particular time is, I suppose, the greater abundance of food suitable for feeding their young at that season, and in a district where these influences exist for a long period, birds would likely enough have two broods; whereas in less favourable circumstances they would restrict themselves to one.

The nest is cup-shaped, more or less deep. It is suspended as a rule between two twigs forming a fork, much in the same way as that of the Golden Oriole, to which it bears a marked resemblance, except of course in size. Sometimes the nest is suspended hammock-like from two or more hanging twigs, a leaf or two of which is often incorporated in the nest.

The nests vary much, but are always soft and delicate, although well and firmly made. The materials of which they are composed are fine grass, rootlets, tow, moss, &c., bound together with cobwebs, thread, vegetable fibres, &c. Generally it is unlined, but sometimes it is well lined with silky down.

The eggs, three or four in number, generally four, are somewhat narrow oval in shape, pointed at one end, but broader varieties are not uncommon. They vary much in size, but usually they measure about 0·62 inches in length by nearly 0·47 in breadth. As Mr. Hume remarks in *Nests and Eggs of Indian Birds*, "abnormally large and small specimens are common;" they vary in length from 0·53 to 0·7, and in breadth from 0·42 to 0·58.

In colour they are pale, unspotted, glossless, bluish-white. Mr. Hume gives two as the normal number of eggs, but my experience is very different, as the following details will show:—During the present season I have examined 63 nests; of these 28 contained four eggs or young; 14 contained three eggs only, but in several cases these were quite fresh, and possibly another egg would have been laid had I not interfered with the nest; the others contained one or two fresh eggs only. In Poona I never found more than three eggs in a nest. They build at various heights from the ground, in low bushes as well as in trees. As a rule they will desert the nest if it is only looked at, more especially if it is unfinished.

I caught one of these Tits with a butterfly net, at Poona, about the middle of September, as I wanted a specimen. About a fortnight later, I saw another in the same place, feeding a young one and teaching it to fly, and after a little searching I found a nest containing two others, so that the surviving bird must have hatched out and reared the nestlings unaided. I left them unmolested, but watched carefully to see if there was more than one adult bird, but from first to last, I never saw more than one. The one I caught was a female.

Poona, April to September.	*H. E. Barnes.*
Baroda, June and July.	*H. Littledale, B.A.*
Khandeish Ghats, July and August.	*J. Davidson, C.S.*

645.—THE INDIAN GREY TIT.

Parus nipalensis, Hodgs.

The Indian Grey Tit occurs sparingly at Mount Aboo, but does not appear to descend to the plains below. It is altogether absent from Sind, but is fairly common near Mhow and Neemuch, as also in Western Khandeish. It is very common at Poona.

They breed from May to August, rearing at least two broods in the season. The nest is a mere pad, composed of hair, moss and feathers, and is placed in a hole in a tree, wall, or bank. I once found a nest in the muzzle of an old cannon, and another in a hollow bamboo used as a rafter in the roof of an old outhouse.

The eggs, four to six in number, are broadish ovals in shape, measuring 0·71 inches in length by about 0·54 in breadth.

They are white in colour, pinkish-white when fresh and unblown, with an irregular ring or cap of red spots and blotches at one end (occasionally this ring is absent), with a sprinkling of purplish and reddish specks scattered over the whole surface of the egg, principally at the larger end.

Poona, May to August.	*H. E. Barnes.*
Mhow, August.	*Do.*
Nassick, June and July.	*J. Davidson.*

646.—THE WHITE-WINGED BLACK TIT.

Parus nuchalis, Jerd.

The White-winged Black Tit has been obtained in Cutch and the vicinity of Deesa. It appears to be very locally distributed. It is probably a permanent resident where it occurs, but I can find no record of its breeding either in Western India or elsewhere.

647.—THE YELLOW-CHEEKED TIT.

Machlolophus xanthogenys, Vig.

I shot a Yellow-cheeked Tit on the Vindhian Hills, near Mhow, which I identified at the time as this bird. I was only there a few weeks, and never met with another specimen, so that I do not feel quite sure that my identification was correct; the skin in question was sent to the Frere Hall Museum, and my label was never called in question. The differences between typical specimens of this bird and the Southern Yellow-cheeked Tit are slight, and they are bridged over by intermediate specimens that might with equal justice be ascribed to either of them. I saw other specimens at Neemuch, but as at that time I entertained no doubt in regard to the correctness of my identification, I did not shoot any. I never found a nest.

648.—THE SOUTHERN YELLOW-CHEEKED TIT.

Machlolophus aplonotus, Bly.

The Southern Yellow-cheeked Tit is a permanent resident on the Sahyadri Range and in the well-wooded tracts adjoining, and is very common at Aboo, and in the jungle at foot, but does not appear to extend far into the open country. I can find no accounts of its eggs having actually been taken within our limits.

I found a nest at Aboo on the 15th April, in a small natural hole in a tree; this I cut open, but the eggs had not been laid, although the nest seemed very complete. The Tits did not desert the nest, although I cut away a great deal of wood before I could get at the nest. I had to leave the hill a couple of days later, so that I did not succeed in getting the eggs.

At Saugor in the Central Provinces, where the birds are very plentiful, I have taken many eggs.

As far as I know, the nests are invariably placed in holes in trees at varying heights from the ground, a favourite place being a hole cut by a Coppersmith (*Xantholæma hæmacephala*), which has already served the makers' purpose. Quite as often they choose a natural hole, which is always small, and entails a great deal of chopping and cutting before the contents can be appropriated. The nests are mere pads, composed of hair and wool, differing in no respect from those of the Indian Grey Tit.

The eggs, from four to six in number, are usually broad ovals in shape, averaging 0·675 inches in length by nearly 0·52 in breadth, but are subject to much variation, both in size and shape, as the following measurement of three eggs, taken at random from three separate clutches, will show: 0·67 by 0·53, 0·67 by 0·5, 0·62 by 0·53; this last appears almost spherical.

All the eggs in a clutch are of the same type. In colour, they are a glossless white (of a beautiful rosy-pink when fresh and unblown), more or less thickly spotted and blotched with reddish and purplish brown. These markings are occasionally more numerous at the larger end, but there is no tendency to form the ring, zone or cap, that is so prominent in eggs of the Indian Grey Tit.

When the markings consist principally of blotches, they are much redder and brighter than when they are composed of spots and specks.

If the hole is cut open before the eggs are all laid, and those already laid taken, they do not forsake the nest, but continue to lay until the full complement is completed, and I have taken an egg out of a nest on four successive mornings.

The breeding season extends from April to August: possibly they have two broods, but I found more nests in July than in any other month.

Aboo, April (nest).	*H. E. Barnes.*
Saugor, C. P., April to August.	*Do.*
Khandeish, May (nest).	*J. Davidson, C.S.*

660.—THE INDIAN CORBY.

Corvus macrorhynchus, Wagl.

The Indian or Bow-billed Corby is more or less abundant throughout the Presidency, with the exception of Sind, where it does not occur.

It is somewhat irregularly distributed, being apparently absent from some localities, in every way suited to it, and which are colonized exclusively by the Ashy-necked Crow (*Corvus splendens*), while in adjacent ones, the Corbies are the most numerous; in others again, both species are equally common.

They are permanent residents where they occur, breeding early in the year, commencing their nests in February, and by the middle of March their nesting operations are in full swing, all their eggs being as a rule hatched out long before the Common Crow begins to think of building.

The nest is of the usual corvine type, composed of sticks and stout twigs lined with hair, vegetable fibre, tow, &c., and is always placed in a tree.

The eggs, four or five in number, are moderately broad oval in shape, pinched in a little at one end, but both spherical and elongated varieties are not uncommon.

They vary a great deal in size, but the average of a large series was 1·73 inches in length by about 1·19 in breadth. In colour they are greenish-blue or dull sap-green, much spotted, streaked, blotched and smudged with sepia, blackish and olive-brown.

663.—THE COMMON INDIAN CROW.

Corvus splendens, Vieill.

The Common Indian or Ashy-necked Crow occurs abundantly throughout Western India, except on the higher ranges, where as a rule the Corby alone occurs. They breed from about the middle of May to about the end of June, making a ragged stick nest, lined with roots, &c., which is placed in a fork in a tree; the eggs, four or five in number, rarely six, are rather smaller than those of the preceding, which they greatly resemble, both in shape and colour. They are subject to much variation. It is in the nest of this bird, that the Koel (*Eudynamys honorata*) almost always deposits its eggs.

It is not unusual to find nests composed more or less of wires taken from soda-water bottles; Mr. Blyth speaks of finding several, two exclusively so, and there is a nest made of the same materials in the collection of the Bombay Natural History, *vide* Journal, Vol. I., No. IV., p. 231.

Mr. Vidal in his "*Ratnagiri Birds,*" gives the breeding season as April and May, and again in November and December, and expresses his conviction that they breed twice a year. This seems to be an interesting departure from the usual order, and I have not noticed anything like it in any other portion of Western India, but Mr. Davidson got numbers of nests in Kanara, along the coast, in October, but he did not notice any there in the early part of the rains.

664.—THE COMMON INDIAN MAGPIE.

Dendrocitta rufa, Scop.

The Indian Magpie, or more correctly the Indian Tree Pie, occurs more or less commonly throughout Western India. It is much more abundant in well-wooded tracts than in others. It is a permanent resident, breeding from the middle of March quite up to the end of July, but May and June are the months in which most nests are to be found. I think at this time of the year, they to some extent leave the plains and retire to the adjacent woods and nullahs, as many more nests are found in the latter situations, and the birds themselves seem to become more abundant, but as Mr. Littledale observes, "they are shy and wary birds when breeding, and the nests in the thick mango foliage are hard to find," they may in consequence often be overlooked. The nest is usually placed in a stout fork, near the top of a tree, not necessarily a high one. Mr. Davidson says that almost all he has seen have been on small trees. It is composed of twigs, those at the bottom being as a rule very thorny, and forming a sort of foundation, upon which the nest proper is placed, as a rule it is well lined with finer twigs and grass roots.

The eggs, four in number, occasionally five, vary most astonishingly, in both the ground colour, and in the character of the markings. Typically they are longish ovals, a good deal pointed at one end. A common type is a pale salmon-white, thickly splashed and streaked with bright reddish-brown; another type is pale greenish-white, and the markings are olive and pale purplish-brown; others are intermediate between these two types; some of these are exact counterparts, except in size, of eggs of the Indian Grey Shrike (*Lanius lahtora*). In length they measure from 1·0 to 1·3 inches, and in breadth from 0·78 to 0·95, but the average is about 1·17 inches by 0·87.

678.—THE LONG-TAILED MAGPIE.

Dendrocitta leucogastra, Gould.

I am indebted to Mr. Davidson for the following note. I do not think that the bird has previously been recorded from Western India.

"This is, I think, a permanent resident in the Ghat portion of Kanara, but it is not a common bird. I have never taken the eggs, but I have seen the young just able to fly; the nest which they had left was on a small tree, about sixteen feet from the ground, in a thick clump, and was a very slight structure, much resembling that of *Dendrocitta rufa*."

The nest and eggs, according to Mr. Hume, do not differ from those of the Common Indian Pie.

681*bis*.—THE LESSER STARLING.

Sturnus minor, Hume.

The Lesser Starling is a permanent resident in some parts of Sind.

The following interesting note is from the pen of Mr. Doig, who appears to be the only oologist who has succeeded in finding the nest:—

*"In February I shot one of these birds, and on dissection found that they were beginning to breed. Later on, early in March, I again dissected one, and found that there was no doubt on the subject, and so began to look for their nests.

"These I found in holes in Kundy trees, growing along the banks of the Narra, and also situated in the middle of swamps. The eggs were laid on a pad of feathers of the Spoon-bill (*Platalea leucorodia*), and the Pelican Ibis (*Tantalus leucocephalus*), which were breeding on

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**Stray Feathers, Vol. VIII., p. 374.*

the same trees, their young then nearly fledged. The greatest number of eggs in any one nest was five. The first date on which I took eggs was the 13th March, and the last on the 15th May.

"The eggs are oval, broad at one end and elongated at the other. The texture is rather waxy, with a fine gloss, and they are of a pale delicate sea-green colour.

"The birds during the breeding time confine themselves closely to their breeding-ground, so much so that except when close to their haunts, none are ever seen.

"The size of the eggs varies from 1·0 to 1·1 inch in length, and from 0·7 to 0·8 in breadth.

"The average of 12 eggs measured is 1·03 by 0·79."

683.—THE PIED PASTOR.

Sturnopastor contra, Lin.

The claims of this species to be included amongst the birds of Western India are very doubtful. Mr. Hume gives Eastern Rajpootana as one of the localities in which it occurs, and I saw it once near Khundwa; further east it is very common.

They breed abundantly in the Central Provinces during May and June, and the first half of July, making huge shapeless nests, composed of grass, straw, roots, &c., which are placed in high trees of various heights from the ground.

The eggs, six in number, occasionally only four or five (I once found seven), are moderately broad ovals in shape, pointed at one end. They vary enormously in size, in length from 0·95 to 1·25, and in breadth from 0·75 to 0·9, the average is 1·11 inches in length by nearly 0·82 in breadth.

In colour they vary from pale spotless bluish-white to pale blue, more or less tinged with green.

684.—THE COMMON MYNA.

Acridotheres tristis, Lin.

The Common Myna is very abundant throughout Western India, except, perhaps, in Ratnagiri and the extreme south, where it is replaced to a great extent by the Southern Dusky Myna.

They are very familiar birds, and are found in greater numbers near houses, being comparatively scarce in unfrequented jungle.

They are, of course, permanent residents, breeding as a rule from the middle of May to about the end of July.

In Kanara they appear to breed earlier, as Mr. Davidson has taken eggs there as early as the middle of April.

They are said to rear two broods during this period, but I am not at all sure about this, the time seems much too short; of course if their eggs are taken, they will lay again. They seem to breed almost anywhere, holes in trees, in walls, or in old masonry wells; in the roofs of houses, on the tops of pillars in verandahs, under the thatch of hay stacks and occasionally in deserted kite or crow nests.

Almost the first nest I found was of a compact cup-shape, and was composed of fine twigs and grass, neatly lined with grass roots and vegetable fibres; it was built in a fork in a babool tree growing in a hedge close to the Parsee Tower of Silence, Deesa, but I have never met with a similar nest since.

The nest is, as a rule, a most untidy shapeless affair, composed of grass, straw, roots, bits of rag, feathers, &c.

The eggs, four or five in number, generally five, are longish ovals in shape, pinched in at one end. In length they average 1·19 inches and in breadth 0·86, but they vary greatly, some eggs measuring as much as 1·3 in length, while others again are little more than an inch.

In colour they vary from a pale-blue to greenish-blue, and are usually highly glossy.

685.—THE BANK MYNA.

Acridotheres ginginianus, Lath.

The Bank Myna is very common throughout the province of Sind; it is equally common in Guzerat and parts of Rajpootana. Mr. Davidson reports it from Western Khandeish and Nassick, and I have seen it in the city of Bombay busily employed in excavating holes in the embankment of the Wodehouse Bridge, near the railway station at Colaba; they did not, however, breed there, as the boys persecuted them too much. They do not appear to occur in the Deccan or anywhere south of Bombay. They are omitted from Captain Butler's list of the *Birds of the Deccan* published in "*Stray Feathers*," Vol. IX., and Mr. Vidal does not include them in his "*Birds of Ratnagiri*."

They are as a rule permanent residents wherever they occur, breeding from about the end of May to the beginning of July, or perhaps later."

They bore holes in the sandy banks of rivers, sides of railway cuttings, embankments, and such like places, showing a decided preference for places close to water. These holes often communicate with each other, so that a bird entering at one hole can easily escape at another, but this is not always the case. I once found a small colony breeding in the sides of a well in company with a few pairs of the Common Myna.

The end of the hole, which is slightly enlarged, is lined with fine grass, roots, feathers, &c.

The eggs, four (occasionally five) in number, are pale spotless greenish-blue in colour, and average 1·05 inches in length by about 0·82 in breadth; they are, therefore, somewhat smaller than those of the Common Myna.

Deesa,	*May to July.*	*H. E. Barnes.*
Hyderabad, Sind,	,,	,,
Neemuch,	,,	,,
Baroda, May.		*H. Littledale, B.A.*
Nowapur, Khandeish, March.		*J. Davidson, C.S.*

686 *bis*.—THE SOUTHERN DUSKY MYNA.

Acridotheres mahrattensis, Sykes.

The Southern Dusky Myna is common along the Sahyadri range and in the adjacent forests. Mr. Davidson says:—"It is common in Kanara and in the southern part of the Nassick district along the ghats. It becomes rare in the north of the Baglam talooka of that district, and I have never seen even an odd specimen which had crossed the small range dividing Nassic from Khandeish. I do not think it replaces the Common Myna. In Kanara the other is quite as common everywhere, and even on the line of ghats in Nassic, both species occur, as in Tanna and Bombay."

It occurs also in the vicinity of Belgaum. They are permanent residents where found, breeding during the hot weather from April to the middle of June. They nest in holes, in trees, stone walls, old buildings, chimneys, &c.

The nest is a shapeless mass of all sorts of material, grass, roots, fine twigs, dead leaves, moss, and lichens, lined with feathers, wool, &c.

This *omnium gatherum* is stuffed into the hole without any arrangement, about six times as much material being used as it is necessary, a hollow being left in the centre for the eggs, which are four or five (occasionally six) in number; they are usually longish ovals in shape, pointed at one end, and average 1·19 inches in length by 0·83 in breadth.

They are glossless, pale, spotless blue or greenish-blue in colour.

Individual eggs cannot be distinguished with any certainty from those of the Common Myna, but as a body they appear narrower and lighter in colour. Mr. Vidal, C.S., in his *Birds of Ratnagiri*, states that the Jungle or Dusky Myna (*Acridotheres fuscus*) is "abundant throughout that district, and more especially in the well-wooded tracts," but the species found there is generally accepted as *mahrattensis*. The two birds are very much alike, the only difference is that in *fuscus* the iris is yellow and in *mahrattensis* it is pale-blue, so that skins are not distinguishable.

687.—THE BLACK-HEADED MYNA.

Sturnia pagodarum, Gm.

With the exception of Sind, where it is very rare, the Black-headed or Pagoda Myna occurs more or less commonly throughout Western India.

They are permanent residents, breeding from the commencement of May to the end of July, or even later. They appear to breed earlier in Kanara, as Mr. Davidson obtained nests with young on the 15th May.

As a rule the nest is placed in a hole in a tree, but I have occasionally found them in holes in stone walls and old buildings.

The nest consists of a few scraps of dead leaves, grass roots, &c., lined with feathers or other soft material. The eggs, four or five in number, are oval in shape, measuring 0·97 inches in length, by about 0·75 in breadth. They vary in colour from bluish-white to greenish-blue. They are spotless and fairly glossy.

Deesa, July and August.	*H. E. Barnes.*
Neemuch, June to August.	*Do.*

Baroda, May and June.	*H. Littledale, B.A.*
Khandeish, June.	*J. Davidson, C.S.*
Nassick Ghats, May.	*Do.*
Kanara, May.	*Do.*

688—THE GREY-HEADED MYNA.

Sturnia malabarica, Gm.

The Grey-headed Myna is much less common than the preceding bird, and appears to be confined to the more hilly and better-wooded parts of the Presidency. It has been recorded from Belgaum and Ratnagiri, and is common along the coast in Kanara in jungles, and is found throughout the Satpooras in Khandeish. It occurs also at Mount Aboo.

I have often seen birds exposed for sale in the Bombay market, generally in company with the Black-headed Myna. The dealers assert that they come from Khandalla. I found a nest containing four young birds at Mount Aboo on the 10th June, but have never met with another; the bird even there is far from common.

The nests and eggs do not differ in any respect from those of the Pagoda Myna.

689.—THE WHITE-HEADED MYNA.

Sturnia blythi, Jerd.

I have never met with a specimen of this bird, but Mr. Davidson, writing from Kanara, has kindly furnished me with the following note:—

" Mr. Hume was of opinion that this bird and *Malabarica* were one species. I am hardly convinced of it yet, though in the cold weather in Kanara a specimen or two of *Blythi* is frequently seen in a flock of *Malabarica*, and in the cold weather I certainly saw once two birds flying together, one of each kind. On the other hand, in April and May, when Mynas are breeding, all the pairs I have noticed above the ghats in Kanara were this species, and in the Satpooras in Khandeish, where *Malabarica* was occasionally seen, I never saw a specimen of *Blythi*.

" I never obtained the nest, though I saw one fly into a hole in a very lofty tree in April. It seemed to have young, but the place was quite unapproachable."

692.—THE SOUTHERN HILL-MYNA.

Eulabes religiosa, Linn.

I have never met with this bird except in a state of captivity, but Mr. Davidson, who has been more fortunate, has kindly supplied me with the following note :—

" This bird is not at all uncommon in the heavy jungles, both above and below the ghats in Kanara. Its nests are, however, hard to find, and I only obtained three ; one containing two moderately set eggs, in the end of April ; the second containing three small young on the 6th May ; and the third containing a single fresh egg on the 20th May. All were in holes in dead trees or branches, pretty near the top, one being in a dead supari tree, a most difficult place for any one to get at.

" The natives told me that the bird invariably chooses dead branches to build in, but of course this is not proved.

" The eggs are very handsome, of a rich blue, marked with large blotches of rusty-red towards the larger end. I have not got the measurement now."

Mr. Hume says the only two eggs he has measured were respectively 1·37 by 0·9 and 1·35 by 0·87.

694.—THE COMMON WEAVER BIRD.

Ploceus philippinus, Linn.

This well-known bird is common throughout the district, on the hills as well as in the plains.

They begin to make their nests soon after the monsoon sets in, but it is not until the middle of the rains that many eggs are laid. They generally breed in company, but occasionally isolated nests may be found ; but as a rule, I think these are never quite finished ; at all events I have never found either eggs or young in them.

A colony engaged in building their nests affords a most interested and animated sight ; they keep up an incessant chirping and chattering all the time they are working. Nests in every stage of construction, sway about at the slightest breeze, some scarcely begun, others so far advanced as to have eggs in them.

The nest, when finished, has been aptly described as retort-shape ; the first portion, which is attached to the extremity of a twig, is solid: this opens out into a bulb-like chamber, which is rounded off at the bottom on one side to form the egg compartment, the other side being continued downwards in the form of a tube, or spout, which forms the entrance. At the commencement the birds seem to work independently, but soon after the solid portion is finished the pair work together; this part varies in length from three to six inches, or even more in length; one bird (I think as a rule the hen) remains inside, the other flies to the nearest clump of sarpat, or other coarse grass, and returns with a long strip in his beak and alighting on the outside of the nest thrusts one end through; the other bird pulls it tight, and then pushes the end out, which is seized by the bird outside, pulled tight, and again passed through, and so on, until the strip is used up, when it flies off for another. The method of obtaining these strips of grass is simple but ingenious; the bird alights upon a stem of coarse grass, bites a notch in a blade, the exact depth required, and then catching hold firmly above the notch flies off, tearing the strip with it; as the edge is very much serrated, the bird has to consider which end to pass through, and it is this that makes it it so difficult to pull a nest to pieces.

The nest, when half finished, presents a very curious appearance, because when the birds have reached the part where the egg compartment is to be, they make a strong transverse loop, on one side of which the entrance tube will be formed, and the egg chamber on the other.

This has to be made very strong, because it will be used later on by the young brood as a perch. This part of the nest takes a long time to make, the birds being very careful over it, many nests being abandoned at this stage, owing to some imperfection in its construction. If the nest is not properly balanced, and perhaps to assist in steadying it, they stick small lumps of clay on the inside. I have found as much as three ounces in six or seven pieces in a nest, but generally much less than this suffices. To see these pieces of clay properly, a nest should be cut open, and it will be seen that almost as soon as the bulb is commenced, the walls on two opposite sides are thicker than usual, forming the foundation of the transverse bar, becoming gradually thicker as it nears the bottom. If the nest is cut down at this stage and reversed, it will look like a basket with a strong handle.

As soon as the chamber is finished, the eggs are laid, but the cock-bird goes on completing the tubular entrance, which is usually about six inches long, but is sometimes much longer ; one that I presented to the Society's collection is twenty-five inches and another twenty-four ; both of these are described in the Society's Journal, Vol. II., Part II., page 106.

A good deal of nonsense has been written about the Baya's nest : one writer affirms that it is commenced at the bottom, which is rested on a leaf ; another recent writer describes the nest as *non-pensile* when, as every griffin knows, it is a perfect type of a *pensile* nest.

Opinions differ regarding the use of the lumps of clay previously alluded to. A poetical rather than a practical notion prevalent amongst the natives is that the Baya uses them to stick fireflies to on dark nights to light up the interior of the nest ; another theory is that the birds use them to sharpen their bills upon.

Regarding the normal number of eggs, much difference of opinion exists, but I went carefully into this question before (see Vol. II., page 105 of the Society's Journal), and further experience has only tended to confirm me in my opinion, which is that the number of eggs is indifferently four or five, as often one as the other.

The eggs are pure, dead, glossless white, and vary a great deal in shape and size, but usually they are longish ovals, pointed at one end, and average 0·82 inches in length by about 0·59 in breadth.

I have myself never met with nests made of any other material than strips of green grass ; but in Ratnagiri Mr. Vidal found them made of coir, and in this case the nests were smaller than usual.

Mr. Hume and others describe nests made of strips torn from banana leaves and from the leaves of the date and cocoanut palms.

695.—THE STRIATED WEAVER-BIRD.

Ploceus manyar, Hors.

The Striated Weaver Bird, although very locally distributed, occurs in most suitable places in the Presidency. It has not been recorded from Ratnagiri, neither did Mr. Davidson meet with it in

Khandeish. It is very common in Sind and Northern Gujerat, and Captain Butler records it from Belgaum.

They breed towards the end of the rains, when the reeds and rushes have attained their full growth. The nest is somewhat similar to that of the Common Weaver-Bird, but owing to its being attached to the tops of a number of reeds, instead of to a single twig, the upper portion is much thicker. The tubular entrance is much shorter as a rule, All the nests I have seen have been composed of strips of grass-blades ; although the nest is typically pendant, yet the leaves of the reeds and rush stems, are often to some extent woven into the body of the nest, affording it considerable stability, but this is I believe more the result of accident than design. The eggs, usually three, seldom four in number, are exact counterparts in shape and colour of those of the Common Weaver-Bird, but average rather smaller.

Deesa (Milana),	*August to September.*	*H. E. Barnes*
Hyderabad, Sind,	,,	*Do.*
Belgaum,	,,	*Captain Butler.*

696.—THE BLACK-THROATED WEAVER-BIRD.

Ploceus bengalensis. Lin.

The Black-throated Weaver Bird seems to be confined to the more northern portions of Western India.

I met with it at Hyderabad in Sind and at Deesa in Northern Gujerat.

At Hyderabad I found what I thought were their nests, but have now reason to think that I was mistaken ; at all events, as I had no gun with me, I could not shoot a specimen.

Captain Butler (now Colonel) in *Stray Feathers*, Vol. VII., page 184, records the following note :—

" Not uncommon about Hyderabad and the country east, and I have noticed nests of all three species, the present, *philippensis*, *manyar* and *bengalensis* on the same tree." I feel sure that he has made a mistake.

All the nests of Weaver Birds that I have seen on trees at Hyderabad were undoubtedly those of the Common Weaver Bird, and all the nests of the Striated Weaver-Bird were attached to the tops of trees or rushes, on the banks of ponds or nullahs.

697.—THE BLACK-HEADED MUNIA.

Amadina malacca, Lin

The Black-headed Munia, within our limits, seems confined to the extreme south of the district. It is far from common in Ratnagiri, and is not uncommon among the rice fields along the coast in Kanara. About Belgaum it is a common seasonal visitant, breeding abundantly, during the rains, in the sugar-cane fields and amongst the reeds and rushes that fringe the border of the tanks and jheels, and along the banks of the rivers and nullahs.

The nests, composed of dry blades of grass, lined with finer grass, are globular in shape, and considering the size of the birds, are very large.

The eggs, four to six in number, are of a pure, dead, glossless white, and are elongated ovals in shape, much resembling those of the Common Munia (*Amadina malabarica*); they measure 0·64 inches in length by about 0·47 in breadth.

Kanara, August. *J. Davidson.*

699.—THE SPOTTED MUNIA,

Amadina punctulata, Lin.

With the exception of Sind, the Spotted Munia is more or less common throughout Western India, but is as a rule very locally distributed.

They are permanent residents wherever they occur, breeding during the rains. The nest is very large, of a globular shape, and is usually placed six or seven feet from the ground, in an acacia or other thorny tree. The materials consists solely of broad blades of grass or bamboo leaves, and it is well lined with fine grass.

The eggs, from four to eight in number, occasionally more, are dead white, measuring 0·65 inches in length by about 0·45 in breadth. As is usually the case with pure white eggs, they have a delicate tinge of rosy-pink when fresh and unblown.

Khandeish, September and October. *J. Davidson, C.S.*

701.—THE WHITE-BACKED MUNIA.

Amadina striata, Lin.

The White-backed Munia is not uncommon at Khandalla. I found three nests not quite finished in a thick foliaged tree, in a garden close to the railway station. Mr. Davidson found this to be the Common Munia in Kanara, both above and below the ghats, apparently building every month in the year, making a small round nest, of the type of *malabarica,* composed of grass, lined with materials of various kinds. The eggs are narrow ovals, and are generally four in number, occasionally five. The nests are generally placed in thorny bushes, three to ten feet from the ground. A very favourite place is also among the thorns, tied six or seven feet from the ground, round cocoanut trees, to prevent people climbing them.

703.—THE PLAIN BROWN MUNIA.

Amadina malabarica, Lin.

The Plain Brown Munia is very common throughout Western India, with the exception perhaps of Kanara. It is a permanent resident, and seems to breed the whole year through. The nest is a rather large loosely constructed sphere, made of fine grass, lined with still finer grass The eggs, from four to ten in number, are rather broad ovals in shape, but are subject to much variation ; they are of the usual dead, glossless white colour.

They measure 0·6 inches in length by about 0·47 in breadth.

I have often found nests built in the foundation of other large nests, such as that of the Tawny Eagle and Common Kite.

704.—THE RED WAXBILL.

Estrelda amandeva, Lin.

The Red Waxbill occurs more or less commonly, in suitable places, throughout the Presidency. It is common in some parts of Sind and in Gujerat, but it is more rare in the Deccan. They are permanent residents, breeding I think twice in the year, once in February and March, and again in October and November, making a rather large globular nest of grass, which however is very difficult to find, as the following note kindly furnished by Mr. Davidson will show :—

"The nests I have generally found on the ground, among thick tufts of grass or among reeds. It is composed of the very finest grass, and is very well concealed, and the hen slips away very quietly; indeed if it was not for the habit the cock has of carrying long pieces of grass to the nest, long after the hen has laid her eggs, I hardly know a nest that would be more difficult to find."

Neemuch, October.	*H. E. Barnes.*
Khandeish, March, October and November.	*J. Davidson, C.S.*
Nassick, February.	,,

705.—THE GREEN WAXBILL.

Estrelda formosa, Lath.

The Green Waxbill is very common on the Vindhian hills near Mhow, also on the Aravelli range. Mr. Davidson reports it from the Satpooras and from the foot of the ghats in Khandeish. It occurs, though somewhat rarely, in the Deccan. It has not been reported from any part of Sind.

They are as a rule permanent residents where they occur, but wander a great deal in search of food.

They are generally found in small parties even during the breeding season. I found them breeding at Mount Aboo at the end of the rains, but I did not take any eggs, as at that time I did not collect them.

Mr. Mortimer, who found them breeding at Saugor, has given me several of their eggs; they are broad ovals in shape, measuring 0·6 inches in length by rather more than 0·48 in breadth.

LIST OF BOMBAY GRASSES.

By Dr. J. C. Lisboa, F.L.S.

PART I.

(*Read at the Society's Meeting on 31st March 1890.*)

Gramineæ is an Order not so extensive as it is generally believed to be. It ranks third in the number of species, but its individuals are numberless. The study of grasses is a subject beset with many difficulties, the spikelets or flowers, being small, nay often minute, and the glumes or floral parts of the same colour. Hence to distinguish one genus or species from the other genera or species, it is necessary to examine the number of glumes, their relative size, their position, their conformation and hairiness, and other minute characters, which demand constant use of the lens and microscope. The subject is so difficult that, in his Preface to the *Flora Australiensis*, Mr. Geo. Bentham, one of the most eminent English botanists, says :—"*Gramineæ* have been the object of special studies of several of the most eminent botanists, amongst which the labours of Brown, of Kunth, and of Trinius have been the most important. But the only general enumeration they have left is that of Kunth, who had not at that time the materials nor yet the leisure to investigate the synonymy, which had already become exceedingly confused. This confusion has been gradually increasing by the large number of species described in partial works, without that general comparison which is especially needed in an order in which a large proportion of the species have a very wide geographical distribution, and it has become more especially involved through Steudel's more recent hasty and careless compilation (*Synopsis Plantarum Glumaccarum*). Nothing, therefore, is now more needed than a careful and judicious synoptical revision of the whole Order. Such a one is now in progress for De Candolle's Monographs by my friend, General Munro, who has for a number of years made *Gramineæ* his special study, as well on living plants in tropical and temperate countries, as on dried specimens from the principal herbaria of the day, and in the correctness of whose views all those who have studied the partial memoirs he has published, feel fully convinced. Without his kind assistance the preparation of this part of my Flora would have been doubly laborious. He has, however, guided me throughout, and although I am far from holding him responsible for the generic and specific arrangement and characters here given, it is to him that I am indebted for many of them, and the whole have been the subject of discussion between us."

Mr. J. F. Duthie, Director of the Botanical Department of Northern India, who has, by the direction of Government, devoted special attention to Indian Botany, and particularly to the fodder grasses, in the preface to his book on "Fodder Grasses of Northern India," acknowledges having received much assistance from Prof. Hackel, of St. Polten, Hungary, a great living authority on grasses.

The study is hampered from want of a general treatise on Gramineæ, or a book on the Indian Grasses. It is true we have Steudel's "Synopsis Plantarum Glumacearum," published in 1855; but of this work, Mr. Bentham says the following in the Journal of the Linnean Society:—"The last general enumeration of *Gramineæ* was that of Steudel, who published in 1855 the first volume of his 'Synopsis Plantarum Glumacearum,' the worst production of its kind I have ever met with."

We have also Kunth's *Enumeratio Plantarum*. The first two volumes contain a description of grasses, which is, according to Mr. Bentham, far too hasty a compilation.

We have books describing almost all the flowering plants and even ferns growing in India and Ceylon, with their drawings, coloured, hand and nature-printed, but we do not possess a good treatise on. Indian grasses. Roxburgh and Dalzell and Gibson in their respective Floras describe many Indian grasses, but there are several important omissions in them, as will be apparent from the list given below. Mr. Duthie's book, alluded to above, is a valuable contribution to the study of grasses, but he confines himself to the fodder grasses of a part of India only, and his descriptions of many genera and species are very short. He has given illustrations of 80 species, drawn by nature-printing process; but they would have been more valuable had they furnished dissections of the spikelets of each specimen.

Another difficulty in the way of the student of Botany is the want of a good herbarium, as in Calcutta and in various parts of Europe, where plants are well mounted and named. The advantages of an herbarium are best known by those who have had occasion to resort to it. Mr. Duthie in his abovementioned book thus describes in a few words the benefit he derived from the Calcutta Herbarium:—"My annual visits to the Royal Botanical Gardens near Calcutta have been of much advantage, more particularly in connection with the strictly botanical portion of this work. In addition to an excellent library there is the splendid herbarium, in which grasses from all parts of India are largely represented."

In Europe investigators receive assistance from many learned men, but here in India very few scientists have leisure enough to devote themselves to the study of grasses, and those who may have formed these the subject of their study, are prevented from giving to others the benefit of their knowledge by their being frequently absent, or moving from place to place in the districts. In Poona, Mr. Woodrow, Professor of Agriculture and Botany in the College of Science, and one of the ablest botanists of the Presidency, has for the last four or five years endeavoured to secure a good collection of plants; but his collection of grasses is comparatively very small, some of which were examined by the late General Munro. Mr. Woodrow has not been able to identify the remaining from want of leisure. Now that Government have sanctioned an annual grant of Rs. 5,000 for the formation of an herbarium, I trust that Mr. Woodrow will employ skilful collectors to complete the Poona College of Science herbarium. Dr. T. Cooke, the Principal of the College of Science, who takes much interest in the welfare and progress of the Establishment, will, no doubt, give his valuable support, as he always does.

I refer to these difficulties, not with the view to enhance the value of my labours, but because the very mention of them will, I am sure, incite ardent lovers of nature to enter upon the field of investigation better armed and duly prepared. I may state here that those who wish to make new discoveries will find many opportunities, as the field is not yet exhausted, for, whilst this list was being drawn up, I received new grasses, which had not come under my observation before, and from those very places from which specimens were formerly sent to me. It happens very often that peons or other persons sent to collect grasses, not being themselves trained, gather large or beautiful and elegant grasses, not heeding the smaller ones, which probably grow under their feet or alongside the bigger specimens.

I am indebted to Mr. Wroughton, of the Forest Department, Poona Division, who, not being satisfied with sending me a good collection of grasses made by his assistants, himself succeeded in supplying me with many, some of which are amongst the rarest. When out in the districts he never forgets to gather for me such plants and grasses as present an unusual aspect. It is thus that he obtained for me *Chloris tenella*, Roxb., stated by both Roxburgh and Dalzell and Gibson to be rare ; the authors of the "Bombay Flora" saw it only at Surat, but Mr. Wroughton discovered it in the Poona district. In a letter sent to me, he writes to say :—"I have founed the delicate grass, *Chloris tenella*, specimens of which were sent to you, in the Loni Reserve on the banks of the Mutha Mulla river, but it is extremely local and by no means plentiful. Since I have found it on the banks of the Nira river in great abundance. Here it grows very luxuriantly. I had to wade through patches which were above my knees and covered a considerable area."

Mr. Madan, Forest Officer, South Thana Division, sent me a valuable collection of grasses from that locality, and this year he had the goodness to forward the duplicates with a packet of a scented grass named *podan*, *gande*, and *pandle*. This proves to be *Andropogon Hügelii*, Hack., a grass not mentioned in Roxburgh's "Flora Indica," nor in Dalzell and Gibson's "Bombay Flora." When in the last rainy season, Mr. Madan was at Satara, acting for Mr. Greathead, he took the trouble of supplying me with a great number of plants from that district, two of which appear to be new species.

In the well-prepared collection sent by Mr. Betham of Nassick and by Mr. Vishnu Mahadeo Tiluk, Range Forest Officer, Haveli, there are many interesting and rare grasses, such as *Arthraxon microphilus*, *Paspalum brevifolium*, *Eleusine mucronata*, and new species of *Tripogon*, *Aristida*, *Garnotia*, &c.

The collections received from the officers in charge of West and East Guzerat, and of the Panch Mahals, Sholapur, Satara, and also from Mr. MacNaughten, Principal, Rajkumar College, Rajkot, and from Mr. W. A. Talbot, of North Canara, are equally interesting.

My thanks are due to all of these gentlemen and to Mr. M. M. de Souza, attached to H. E. the Governor's establishment, and to Mr. J. M. de Souza, to that of the Superintendent of Mahableshwar, for their contributions of grasses from that hill, and also to the Rev. C. X. d'Abreu for a few plants from Goa.

These collections have afforded me convincing proofs that there is still ample field for research and exploration, and those students of Botany, who may think of devoting their attention to the study of grasses, will certainly reap a large harvest. The examination of these contributions has also enabled me to form a general idea of the grass vegetations of this Presidency, excepting Scinde,* especially of fodder grosses, and to furnish a reply to a reference received by me from the Director of the Land Record and Agriculture on the subject.

I am also much indebted to Mr. Duthie for valuable notes with which he has favoured me regarding some specimens of grasses which were submitted for his opinion in September last. Moreover he generously offered to send doubtful cases to Prof. Hackel for his identification.

In the preparation of this list I am much indebted to Mr. Shuttleworth, Conservator of Forests, N. C., through whose kindness I was able to obtain the abovementioned very useful collections of grasses in the various districts under his charge. I am grateful indeed for the ready assistance he kindly gave me, and for the trouble he took in writing to all of his assistants and recommending them to send me grasses.

Not being acquainted with the Conservator of Forests, S. C., I refrained from writing to that gentleman. I am sure he would have likewise assisted me with contributions from the districts under his charge.

I have to convey my special thanks to Mr. J. M. Campbell, C.S., Collector of Panch Mahals, who, on learning from me that I had taken up the subject of the study of grasses, encouraged me to carry it out on a more extensive plan than I had intended, and wrote to Mr. Shuttleworth to obtain for me through his assistants materials from his Circle. He evinced so much interest in my endeavours that in spite of his being very busy with his own arduous duties, he carried on for a short time a correspondence beween himself and Mr. Shuttleworth on one side and myself on the other. He even assisted me in obtaining from different officials of Khandesh, *Rosha-grass* and its oil, about the quality of which I had some doubts. Mr. Campbell has done this not so much out of friendship towards me as one might suppose, but with the view of rendering me assistance in my study. His desire of encouraging scientific and literary pursuits generally in this country, he himself being an ardent worker, is well known.*

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* I have seen a few from this place.

In writing this Catalogue I have arranged the genera in accordance with the *Genera Plantarum* of Bentham and Hooker, the species being placed under each genus according to their affinities as I understand them. After the scientific names of the grasses in the list, I have copied the Vernacular names of almost all the grasses which were attached to the collections received from the various districts of the Presidency, to satisfy the curiosity of the reader. It is generally thought that every grass should have a name. This is an error, for very few grasses are known by their proper Vernacular names. As in European countries, so also in India, the same plant has different names in different provinces, nay even four or five in the same province or village, and the same name is not unfrequently given to a variety of plants and great many names to the same plant, *e. g.*, the Vernacular name of *Payen* is given to *Andropogon intermedius*, *A. odoratus*, *A. pertusus*, and *A. annulatus*, probably because they resemble each other, and have all their several spikes congested at the end of their culms. Vernacular names are often invented to please the *Sahib*, or to impress upon him the informer's knowledge: thus we have *Kali kussal*, *Panre kussal*, *Jungli kussal*, names given to grasses belonging to various tribes and genera, without any affinity, merely because the plants named are endowed with long awns. The fragrant roots of an *Andropogon* named *Khas-khas* are known all over India, but the plant itself has different names in different provinces; of course, rice, nachni, bajri, jawari and kodra are well-known, but there are several varieties of other cultivated grain plants, such as *Panicum miliacium* and *P. miliare*, some of which even botanists themselves find it often difficult to distinguish by their Vernacular names.

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* I apologise for my acknowledging with gratitude the kind assistance rendered me by the gentlemen above mentioned, as it is not usual to do so in a paper like this. I deem it my duty to convey publicly my thanks for the favours received. Since these notes were written, Government has passed a Resolution directing the three Conservators of Forests to supply me with specimens of grasses from their respective circles.

Bamboos are well known to people who work and deal in them in different districts, but even here the names vary in each province.

The names given are often fanciful to please the *Sahib,* as stated above. If, after the lapse of some time, the man be asked, he will give you a different name from what he had done previously. The names of some of the grasses written in the duplicates received this year are not the same as those which were assigned to the same plant last year. For these reasons I set very little value on them. For there is no certainty that these names before being attached to each species were verified by an intelligent person. Mr. H. C. Davidson, of the Revenue Survey Department, has collected grasses and herbs which grow in Alibagh on the fields amongst the rice, bajri and other food grain crop. After drying and mounting them properly, he attaches to each specimen a paper inscribing in a few words the uses and the Vernacular names after due enquiry. It is only by such means that we can ascertain the true Vernacular names, and render them useful to those who are desirous to know, and thus indirectly promote the advancement of the science of Botany. It is thus that their value in tracing the history of the plant may be enhanced. By the method adopted by Mr. Davidson we have before us a specimen of a plant with its well ascertained Vernacular name.

As to the Sanscrit names they are not more reliable than the Vernacular ones, being founded on less ascertained observation and description of the essential characters of the plants.

In regard to the uses of the plants, I have made use of the short statements of Mr. Duthie made in his "Fodder Grasses of N.-W. India" and of Mr. Fergusson in his "Catalogue of Ceylon Grasses," especially when my information did not differ from those statements.

Finally I submit this Catalogue, which for obvious reasons cannot but be brought out in parts, to the kind appreciation of this Society.

Additions and corrections, which may be made, and advice proferred, will be received with thanks.

GRAMINEÆ.

Tribe—PANICACEÆ.

Sub-Tribe—Paniceæ.

Genus—Paspalum.

P. Kora, Willd., Roxb. *Fl. Ind.* I., 278, 279; Dalz. and Gibs., *Bomb. Fl., Suppl.* 97.

This is probably the wild state of *Paspalum scrobculatum.* It grows in all districts, but not in abundance.

P. scrobiculatum, Linn.

Vern.—Koda, Kodra, Harik, Pakodi, Pakod. Cultivated all over the Presidency. The following is reproduced from my work, "The Useful Plants of the. Bombay Presidency," which forms part of the 25th Vol. of the *Bombay Gazetteer*:— "Several varieties of this grain are mentioned by the natives, the differences in them being probably due to differences in the soil, method of cultivation, &c. Two sorts are, however, well known: the wholesome and the unwholesome. The former is smaller and paler than the latter, and goes by the name of *pakodi* or *harik* in the Konkan. In Goa it is called *Pakod.* The unwholesome variety is called *dhone* or *majari, harik* in the Konkan, and *mana kodra* in Gujarat. In Sanskrit it is named *Kodrava* (injurious). The grain is said to be the only poisonous part of the plant. Although the two principal varieties have been styled respectively wholesome and unwholesome, the arrangement is only one of convenience, for all the varieties are, as a matter of fact, more or less poisonous, and the highly poisonous seed of one locality, when sown in a different soil from that which produced it, may yield a grain whose properties have become either modified or intensified, according to the peculiarities of the localities."

Kodra grain is a common article of food with all the poor people in India. They prepare it by macerating it for three or four hours or more in a watery solution of cowdung, when the scum and the deteriorated grain which rise to the surface are separated and the good grain removed and spread out in the sun to dry. This process is repeated so long as any poison is suspected to remain in the grain. Boiling does not entirely destroy the poison, but if the grain is kept for a number of years, its poisonous properties are found to diminish. When required for use it is ground in stone mills, and then pounded and winnowed, which process separates the different layers of the testa, and leaves the grain fit for use. Kodra is more readily cooked than common rice, and it is very extensively used in the Konkan as also in Gujarat, by men and cattle, mixed with whey, the latter being supposed to have the power of neutralising its poison. Notwithstanding all precautions, however, cases of poisoning do occasionally occur, though they seem rarely attended with fatal consequences. Surgeon-Major Pirie, who has described a case of Kodra poisoning (*vide* "Transactions of the Medical and Physical Society of Bombay," 1869, No. 9, New Series,) thus enumerates the symptoms :—

"Unconsciousness, delirium with violent tremors of the muscles, pupils dilated, pulse small and weak, skin cold and covered with profuse perspiration, and difficulty in swallowing." No mention is here made of vomiting, which is one of the earliest symptoms. Fourteen persons belonging to four indigent families were taken to him suffering from the above symptoms, which had come on about six hours after the Kodra had been eaten, and in extreme cases had lasted eighteen hours. All the persons recovered under emetics, stimulants, warm clothing and heat applied to the surface.

It will have been remarked by such members as belong to the Medical profession, that the symptoms given above are much like those of poisoning from datura, except the tremors, which are not met with in the last.

The regular use of Kodra seems to establish a sort of tolerance of the grain ; but it is believed by people that if partaken with black pepper, even by habitual consumers, deleterious effects soon show themselves.

The evil effects of unwholesome Kodra are far more severe in cattle than in man, due no doubt to their eating the grain, husk, &c., also to the asbence of vomiting, an effect that almost always takes place in man. It proves fatal in quantities of about two and a half ounces to such large quadrupeds as horses, cows, &c. (more so to the former), and has also been known to kill buffaloes, goats, and asses. The active principle that produces these fearful effects has not, as far as I am aware, been yet isolated. Messrs. Duthie and Fuller

(*Field and Garden Crops*) attribute them to a ferment supposed to be generated in the grain, Drs. Pirie (*l. c.*) and Bonavia of Lucknow (*Ind. Med. Gaz.*) to a kind of fungus, which subsequent observers failed to detect. Dr. Lyon (*Med. Jurisprud. for India*) classes Kodra along with Darnel (*Lolium temulentum*) and *Lathyrus sativus* as a cerebral poison, and does not *mention any* fungus as being *present in the grain.*

Natives have various antidotes for Kodra poisoning. The most usual ones are gruel made of the flour of *urid* (*Phaseolus radiatus*), the stem of plantains, which is rich in tannin and alkaline salts, the astringent juice of the leaves of *Psidium guava* or the leaves of *Nyctanthes arbor tristis.* Whey has been mentioned before. It is used in Damaun and the neighbouring villages.

P. minutiflorum, Steud. *Syn.*—Gram 1, 17; Benth., *Fl. Austr.* 7, 461. All over tropical Asia. My specimens are from Poona, Nassick and Thana, where it is very common. It is eaten by cattle, especially when green.

P. brevifolium, Flugge; Kunt. Enum. 1, 48. *Panicum tenuiflorum*, R. Br.

Poona and Nassick, not common; also in N.-W. India and Australia. Uses as fodder grass unknown.

P. costatum, Hochst.

At Mahableshwar and Lanowlie: at the latter place not uncommon under the trees in the place known as *Lanowlie Woods.* It is an elegant grass, ½—1 foot high, with horizontal secund branches.

ERIOCHLOA, *Humb. and Kunt.*

E. annulata, Kunt., 1, 73; *Paspalum annulatum*, Trin., Sp. Gram., t. 133. It is rare, but is found at Chowpatty (Bombay), North Kanara, also all over India, Ceylon, and Australia.

ISACHNE, *R. Br.*

I. australis, R. Br. Prodr. 196.

Panicum atrovirens, Trin., Kunt. Enum. 1, 127.

P. antipodum, Spreng. Syst. 1, 314.

Vern.—Doaria or *Daurra*, *Mez* (Mount Abu). Common in Poona, Nassick, the Ghauts, and Guzerat. Also in other parts of India, Ceylon, and Australia. It grows in fields destroying the crops.

I. elegans, Dalz. and Gib., *Bomb. Fl.* 291.

Vern.—Doonda. Not seen by me.

I. Dispar, Trin., Sp. Gram., t. 86.

Is this Dalzell's *I. elegans?* Uses not known.

PANICUM, *Linn.*

P. sanguinale, Linn., Kunt. Enum. 1, 82.

P. Ægyptiacum, Retz. (A variety of the last). *Milium sanguinale*, Roxb., *Fl. Ind.* 1, 315.

Vern.—Fakri and *Fakria.* It is common all over.

P. ciliare, Retz., Kunt. Enum. 1, 82.

Vern.—Kurad, Sicka. A variety of *P. sanguinale.* Common in most warm countries.

P. commutatum, Nees in Linnea.

Is it a variety of *P. sanguinale?*

P. conjugatum. Roxb., *Fl. Ind.* 1, 282. First described by Roxb. as a distinct species. Dalz. and Gib., *Bomb. Fl.* 291, not seen by me. Is it a variety of *P. distachyum?*

P. flavidum, Retz., Obser. IV. 15; R. Br. 198.; *P. brizoides*, Trin. Sp. Gram. t. 158; Roxb., *Fl. Ind.* 1, 293.

Dalz. and Gib., *Bomb. Fl.* 290. It occurs in Poona, Surat and throughout India and tropical Asia in general. Common on the plains and even on low elevations on the hills. It is reckoned a good fodder for cattle. The grain of this species, which is by no means scanty, is eaten by the poorer classes, and especially in famine times. It extends to Australia, and there it is found that its panicles lie prostrate from the weight of the grain. Prof. Church found that the fibre of this species is much more indigestible than that of any other. Its chief constituent is fat, or oil.

P. fluitans, Retz., Obser. III. 8; Kunt. Enum. 1, 78; Roxb., *Fl. Ind.* 1, 294; Dalz. and Gib., *Bomb. Fl.* 290.

P. truncatum, Trin., Sp. Gram. t. 68.

Vern.—Pet-nar (Bomb.); *Dossa* (Telling; name.)

It is found in Poona near water-courses and in moist situations, also all over India, and in the tropics of both the hemispheres, but not common.

P. erucæformæ, Sibth., *Fl. Græca.* t. 59; Kunt. Enum. 1, 78.

P. caucasicum, Trin., Sp. Gram. t. 268.

Vern.—Shimpi, wag-hakt. All over Bombay but not common; also in other parts of India. Eaten by cattle; considered to be a good fodder grass, but it is rather scanty.

P. prostratum, Lamb Illustr. 1, 171.; Trin., Sp. Gram. 184, 185; Dalz. and Gib., *Bomb. Fl.* 290.

Vern.—Sarpur, Chaurila. Common in Poona, Guzerat, Surat, and throughout India, Africa, the West Indies and Australia. It is considered as a good fodder grass, and produces a considerable quantity of grain which is eaten by the people in times of scarcity. Cattle are fond of it.

P. helopus, Trin. in Spreng. Neue. Entad., 11, 84; Trin., sp. Gram. 183.

Urochloa pubescens, Beauv. Argost.

Urochloa panicoides, Beauv. 52, t. 11, fig. 1. Dalz. and Gib., *Bomb. Fl.* 290.

Vern.—Kuri, Kuria. It is reckoned to be a good fodder grass for both horses and cattle. The cultivated parts of the plains abound with it. It extends even to about 5,000 feet on the Himalayas.

P. cimicinum, Retz. Obsv. III. 9.

Milium cimicinum. Linn., Mant. 184.

Urochloa cimicina, Kunt. Gram. 1, 31; Dalz. and Gib., *Bomb. Fl.* 289. It is found all over India.

P. distachyum, Linn.; Kunt. Enum. 1, 91.

P. subquadrifarium, Trin., Sp. Gram. t. 186.

Vern.—Motia. It is found in Damaun, Poona, and is scattered all over India, the Malayan Archipelego, and Australia, but rare. It is said to be cultivated in Australia for fodder, which it produces in large quantity.

P. colonum, Linn., Trin., Sp. Gram. t. 160.

Oplismenus colonus, Kunt., Enum., 1, 142; Roxb., *Fl. Ind.* 1, 296; Dalz. and Gib., *Bomb. Fl.* 291.

Vern.—Bovur, Shama, Sarvank, Pacad, Tor, Todia, Jiria. Common all over India, Australia and many parts of America.

It is highly valued as an excellent fodder grass. It is even found on the Himalayas. It grows on well cultivated or rich soil. It is much relished by cattle. Its nutritive qualities are enhanced by its grain, which yields in abundance. The grain is said to be sold in the bazaars of the N.-W. Provinces, and is much used by poor Hindoos on their fast days, but the higher classes do not set any value on it, and eliminate it from rice, with which it is often mixed by the dealers. Its succulent stems are said to grow from 2 to 8 feet in Australia.

P. Crus-Galli, Linn., R. Br. Prod. 191. Trin., Sp. Gram., t. 161,162; *Oplismenus crus-galli*, Kunt. Enum. 143; Dalz. and Gib., *Bomb. Fl.* 292.

Vern.—Bovur, Pacad. Common weed in most hot and some temperate countries. It is similar to *P. colonum*, but coarse. The grain is not considered to be possessed of good nutritive qualities and is mostly consumed by the poorer classes. It is sown in the N.-W. Provinces for its grain, and in Rajputana used as fodder. It thrives well in Australia. In America it is highly esteemed under the name of "Barn Yard Grass." In his "Report on the Agricultural Grasses of the United States," Dr. Vasey writes: "It is greedily eaten (at Mobille, U. S.) by horses and cattle "and makes a hay of good quality. It is justly regarded as an "excellent grass, particularly before it ripens its seeds. In Louisiana, 'Mississippi and other States, it is mowed annually and yields as "much as four or five tons of hay per acre. Two cuttings are procurable each season when mowed as soon as it begins to bloom. It "re-seeds the ground, and requires no care save protection from live-"stock. Cows and horses are very fond of it, green or dry."

P. petiverii., Trin., spec. Gram. t. 176. In Poona and plains of Northern India. Rare. Cattle eat it. It is a good fodder.

P. myosuroides, R. B. Prod. 189.

P. angustum, Trin., sp. Gram. t. 334.

Vern.—(Kora-Lom.), Pokalia, Didhina, musa-punchi, suphetkar. It grows in Alibagh and on low wet ground. It is eaten by cattle with relish; it also grows in Queensland in Australia.

P. myurus. Lam.; *P. interuptum*, Willd., Kunt. Enum. 1, 86; Roxb., *Fl. Ind.* 1, 286.

Vern.—Pokelia. Not uncommon in Thana, Konkan, Ceylon, in warm wet ground. It is not a good fodder grass. In Australia, however, it is considered to be nutritious to cattle.

P. antidotale. Retz., Kunt. Enum. 1, 125.

Vern.—Git, Sera, Male, Shamukha, Gharam Ghamar, Girni, Mangrur, Baru, Barwari, Barigagli.

It is a coarse grass, not generally considered to be a fairly good fodder grass, but is used when superior qualities fail. Mr. Coldstream reporting from Hissar states that it is grazed only when green, as it afterwards becomes bitter or saltish, and poisonous to cattle. Its smoke has the reputation of a disinfectant in small-pox and in healing wounds. In Madras it is used in throat affections. It extends to N. Australia.

P. repens, Linn., Kunt. Enum. 103; Roxb., *Fl. Ind.* 300.

Vern.—Berod. It grows all over Bombay and Northern India, and extends to Ceylon and Australia. It also occurs in N. Africa, South Europe, and on the coast of Brazil. Both horses and cattle relish it as a good fodder grass. Roxburgh states that cattle are fond of it. Mr. Ferguson in his "Grasses of Ceylon" says:—"It is indigenous to Europe, Africa, Asia and America, and in Ceylon grows equally well in the dry sandy soil, as it does in marshes or water, its long creeping underground stems enabling it to endure the hot dry weather. It is one of the most difficult plants to get rid of once it establishes itself in any locality, and in this respect resembles the *Triticum repens* of Europe. It is found from the sea up coast to Newera Eliya, and is a common weed on some coffee estates."

P. Roxburghii, Spr. Steud., Syn. Gram. 98.

P. tenellum, Roxb., *Fl. Ind.* 1, 309.

I am unable to describe it, as it is only marked in my notebook as having been seen on Malabar Hill some five years ago.

P. hermaphroditum, Steud., Syn. Gram. 1, 67; Benth., *Fl. Austr.* VII., 485.

Vern.—Pokelia. Thana, Konkan, and Poona. Uses not known.

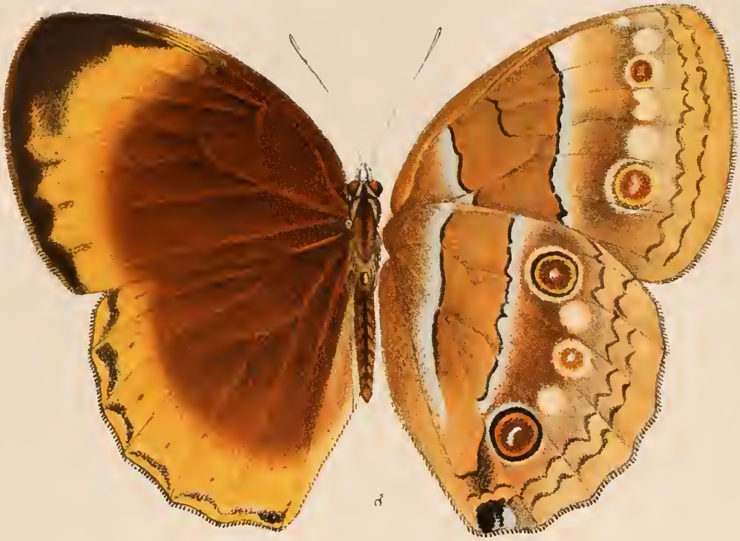
P. radicans, Retz. Obs. IV. 18; *P. accrescens,* Trin., Spec. Glum. t. 88.; Steud. Glum. 1, 87. From the Collection in the Poona Science College.

P. decompositum, R. Br. Prodr. 191., Benth., *Fl. Austr.* VII. 489.

P. paludosum, Roxb., *Fl. Ind.* I. 307.

Vern.—Boruti and *Kulus-nar,* Roxb. Not uncommon in Poona, Lanowli and Salsette

L. De NICÉVILLE, Journ. Bomb. Nat. Hist. Soc. 1890. Vol. V. Pl. C.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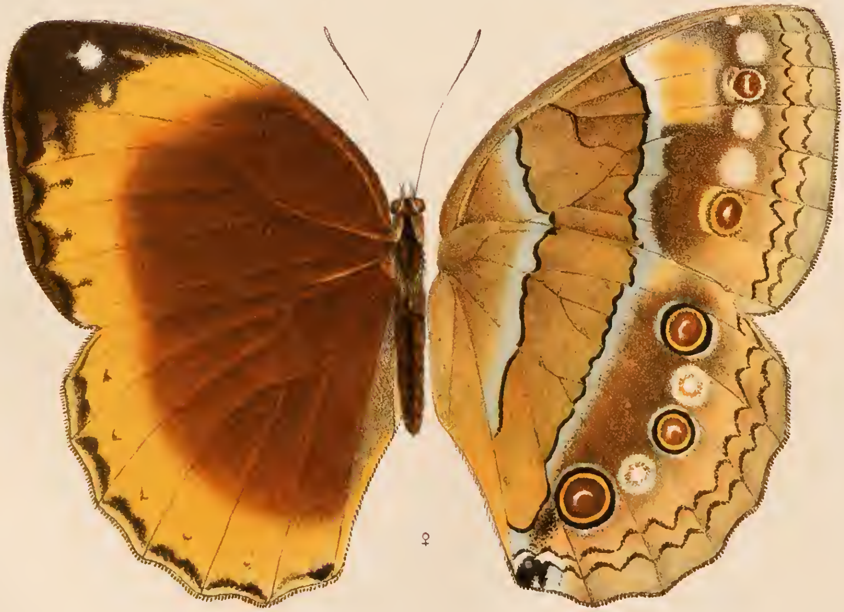
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Grish Chunder Chuckerbutty del. West, Newman Chr. lith.

STICHOPHTHALMA NURINISSA.

P. plicatum, Lam. Enc. IV. 736; Trin., Spec. Gram t. 223.

P. Nepalense., Spr. Syst 1, 321, Dalz. and Gib., *Bomb. Fl.* 291.

P. plicatum, *P. costatum*, *P. nervosum.* Roxb., *Fl. Ind.* 1, 311.

Parel and western side of the ghats; also in Ceylon up to an elevation of 2,000 feet.

P. montanum. Roxb., *Fl. Ind.* I., 313; Kunt. Enum., Plant. 1, 126.

Ver. Lalket.

Thana, place named Khardi. Dispersed all over India as far as S. China. Uses not known.

(*To be continued.*)

DESCRIPTION OF A NEW MORPHID BUTTERFLY FROM NORTH-EASTERN INDIA.

By Lionel de Nicéville, F.E.S. C.M.Z.S., &c.

With Plate C.

Stichophthalma nurinissa, n. sp.

Habitat: Bhutan.

Expanse: ♂, 3·4 to 4·0; ♀, 4·5 to 5·0 inches.

Description: Male. Upperside, *both wings* differ from those of *S. nourmahal*, Westwood, from Native Sikkim* in the ground-colour being of a much brighter shade, red chestnut instead of fuscous chestnut; in the broad fulvous outer band extending uninterruptedly from the middle of the costa of the forewing to the anal angle of the hindwing, being twice as broad on the hindwing, and not inwardly bounded as in *S. nourmahal* by V-shaped markings, which are obsolete, being reduced to obsolescent small rounded dots placed on the internervular folds. Underside, *both wings* also with the ground-colour much lighter and brighter, the subbasal black line inwardly, and the discal black line outwardly, margined by pale greenish of a duller and less rich shade than in *S. nourmahal*. Female differs in precisely the same way as the male, and in addition has the white spot at the apex of the *forewing* on the upperside more than twice as large.

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* Mr. A. V. Knyvett has obtained three males and a female of this species in Native Sikkim two years running in August: it has also been recorded from Borneo.

Described from numerous examples captured during the last three or four years in Bhutan by the native collectors of the late Mr. Otto Möller and Mr. A. V. Knyvett. Having lately had an opportunity of examining the true *S. nourmahal* in the latter gentleman's collection, I am able to describe the Bhutan species. The differencee given above in the coloration and markings of the two species appear to be perfectly constant.

For the benefit of those who do not understand Arabic, I may note that Nur-mahal means "Light of the House" and that Nur-i-Nissa is "Light of Women."

PREHISTORIC BOMBAY.*

By W. E. Hart.

Those who have walked about Bombay with their eyes open during the last twenty years must be struck with the changes which have taken place during even that short period, and which are tending entirely to alter the physical aspect of the island. As more houses are built, and more roads constructed in a space limited by the waters of the sea, what is closest at hand will be taken to furnish the materials of which they are to be made, and the ground on which they are to stand. So it is that we now see on all sides our hills being levelled, our hollows raised, and our foreshores reclaimed, till the whole island bids fair soon to be a flat oval, raised only a few feet above the sea. Then, when Lord Macaulay's New Zealander, educated into a cold-weather globe-trotter, arrives from the ruins of London Bridge at those of the Apollo Bunder, he will hear with wonder of Malabar Hill and Back Bay, and ask with incredulous surprise how they could ever have existed, or, having existed, whither they have disappeared. He will not however be in the plight of the traveller of the Eastern fable, who, on revisiting the same spot at intervals of a thousand years, and finding it, now a city, then a lake, and again an arid waste, was informed by the inhabitants on each occasion that it had always been as he then saw it. For, of the changes now in progress round us, the history will be preserved in many written records.

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* This paper was originally read by Mr. W. E. Hart, as a popular lecture, at the Sassoon Mechanics' Institute, Bombay, on the 10th March 1890. It is republished, here, as it is likely to be of interest to many members of the Society, inasmuch as it gives, in a convenient form, the result of the researches of such men as Buist, Clark, Wynne, Medlicott, and Blanford, collected from a large number of technical and scientific publications.—Editor.

But I am to speak to you to-day of changes far greater than those now in progress, effected in the ages before there were any men on earth to write their record. How then, you ask, can I know of them? Well, I frankly admit I cannot *know*, in the sense of absolute certainty. But what is there we can so know? Even in matters of history, we are liable to be misled or misinformed through the partiality or ignorance of the human historian. This risk at least we escape in dealing with prehistoric times. For, as to them, there lies at our feet a book, written by the hand of Nature, in letters that cannot lie. True it is, we can open only a few of its pages, and possibly may misread the characters we find traced even on these. But that is the misfortune of the reader, not the fault of the writer. The whole truth is there, if we can decipher it, and one or two of these pages I ask you to turn with me to-day.

But before we do so, see how just a metaphor is that of the book. You all know that this globe of the earth which we inhabit is not a homogeneous mass from the surface to the antipodes, nor even all over its surface. The solid constituents of its crust are composed of different rocks, arranged one above the other in layers, or "strata," like the leaves of a book, and, like the leaves of a book, always in the same order. In some places some of the strata may be missing, as sometimes pages from a book. But you never find the order of the strata reversed. You never, for instance, find the chalk below the coal, nor the coal below the old red sandstone, any more than in a book you find the second leaf before the first, or the third before the second. Though, digging through the chalk, you may, in some places, reach at once the old red sand-stone, without passing through the intervening coal, just as, in turning the leaves of a book, you may find the third leaf next after the first, if the second has been omitted by the binder.

Then, you know that from beneath this solid crust a mass of molten rock here and there finds a vent in volcanic outbursts, and streams over the surface in lava flows. Of these we shall have more to say in discussing the origin of Prehistoric Bombay.

But first I will ask you to take a glance at Bombay as she is. Standing on the rocky cliff, near the flagstaff where the English mails are signalled, on the east face of Cumballa Hill, near the north end of the ridge, you get, on a clear day, a fine view of almost the whole island, and see that it is roughly not unlike my left hand held towards you with the thumb and forefinger extended, and the other fingers closed. The forefinger is then the eastern side of the island, ending southward in the longer prominence of Colaba, while the shorter ridge to the west, ending southward in Malabar Point, is represented by the thumb. The space between them is Back Bay, while the Flats extend over my wrist to where the island ends at Sion on the east and Worli on the west, about a third of the way up my forearm.

Now look back along the ridge near the north end of which you are standing. You see it rises precipitously from the sea at the south end at Malabar Point, whence it gradually reaches an elevation of about 200 feet, and, with the exception of the depression through which the road passes from the Gowalia Tank to Breach Candy, it runs almost continuously for about 3 miles, till it ends precipitously to the north at Mahaluxumi. On the other side of the Vellard, it rises again at Love Grove, but is again breached by the depression at the Pumping Station, through which the main drain flows out. On the other side of this, it rises again in the Worli ridge, which ends precipitously to the north in the inlet of the sea at Mahim Bay, the south shore of which forms the sands, so well known to equestrians, marking the northern limit of our island on the west.

North of the bay, however, the rocky ridge rises again at Bandora, in the island of Salsette, and is thence continued, with similar interruptions, northward along the coast, past Versova, Myr Island, Dharavi, and Bassein, to Arnalla.

This ridge on which you are standing then is part of a great sea wall of solid rock, here some half mile thick through from east to west, which protects some 35 miles of the western shores of India from the encroachments of the sea. Here and there, we have seen, it has itself suffered from the inroads of the waves. But how well it is calculated to withstand their fury, even during the onslaught of the S.-W. monsoon, to which it stands full exposed, you can see if you examine the rocks around. As the quarry-men at work below will tell you, they are so hard as to be incapable of " dressing," and require the finest steel-pointed crowbars for the making of the holes in which to put the blasting charges by which alone they can be rent.

Now, look again at the ridge on which you are standing. Through its whole length, you see, it rises precipitously on the eastern side, but slopes gradually to the west. The reason for this you will find presently, when examining more attentively the strata exposed by the operations of the quarry-men aforesaid. You will then see that these strata are not laid quite horizontally, but are tilted at an angle of some 15° from east to west. Yet they are all parallel to each other, so that the tilting force must have been applied to all alike, after they had been formed. This tilt, or " dip," as it is technically called by geologists, by unequally exposing the strata on the declivity to the action of the weather, has caused the gradual slope to the west. But before proceeding to a closer investigation of the structure of our island, let us look over its surface from our post of vantage. At our feet lies a flat expanse of low ground, some of it evidently below the level of the sea outside, which is excluded by the causeways at the Mahaluxmi Vellard, Worli, and Sion. It stretches from the base of the western ridge on which we stand, eastward, unbroken by any eminence, till it reaches the chain of rocky hills that mark the eastern limit of the island at its northern end.

This level plain, between the two lines of raised rocky ground on its west and east, is evidently of different formations; for you see the southern portion, extending a short distance inward from the shore of Back Bay, over the quarters of Girgaum and Khetwady, is covered with a dense growth of cocoanut palms, indicating a sandy soil; while the bare treeless rice-fields, stretching away northward, show that we here have clay, till a patch of sand occurs again in the extreme north, as shown by the cocoanut palm groves that follow the curve of the Bay at Mahim.

A nearer though still superficial look at the soil in these places will show that the sandy portions are full of remains of sea shells, proving their marine origin; while remains of vegetation and estuarine shells in the clay portions show that they are formed of the mud deposited by tidal creeks.

But before descending to examine the Flats, look right across the island at the chain of rocky eminences that form its eastern shore towards its northern end. These, though not so high as that on which we stand, nor so unbrokenly continuous, yet seem to partake of its general characteristics. There is the same ridge shape, and the ridges lie in the same general direction, north and south. They also, like the western ridge, are steep on the eastern face, but decline gradually towards the west, and if you cross the island and examine the quarries there, you will find it is for the same reason. You see, too, regarding the eastern line of eminence as a whole, that, like the western, it is, generally speaking, higher towards the north than the south, where, indeed, on the Eastern coast, the rocky shore from Nowroji Hill to Colaba Point is raised very little above the sea. The reason, no doubt, is the same, *viz.*, that the portion most exposed to the sea and weather, especially during the S.-W. monsoon, is most worn away.

The fact, however, that the lowest part of the eastern ridge at Colaba has been worn so much lower than the lowest part of the western ridge at Malabar Point, while the eastern ridge is neither so continuous nor so high as the western, shows that the rock on the east, though partaking of the same general characteristics as that on the west, is of a texture less suited to resist the action of the weather. This our friends the quarry-men would seem to say, when they tell us that the Sewri stone is good for building, as it can be cut to what form they please; while the Walkeshwar stone is useless for building, as it is so hard that it cannot be cut, and will only break in such direction as itself chooses.*

But before we proceed to a more detailed examination, standing up here yet another moment, let us try to picture what would be the scene, were water spread over the surface now occupied by the flat plain below us. It requires no violent effort of the imagination to see that if the artificial dams at the Vellard, Worli, and Sion causeways, and the natural barriers formed by the heaping of sand-banks at Mahim and Back Bay were removed, so as to freely admit the sea, only the higher points of these two chains of rocky eminences on the east and west would escape submersion. But the soil that now connects them is, as we have seen, in part nothing but the clay deposited as silt by tidal creeks, and in part only the sea-sand heaped up by the waves and winds.

Here, then, is the first fact recorded on the first page, lying open at our feet, in the book of which I spoke. Bombay was not formerly one island as now, but a number of small rocky islets, ranged in two nearly parallel rows and separated by the waters of the sea.

That this was to some extent so even during their human occupation, is proved both by recorded facts and the tradition of local names, for we find Mahim mentioned in an ancient manuscript as a separate island; and from Dr. Fryer's account of his visit just 220 years ago, it would seem that Mahim, Worli, and Love Grove, were then all three separate islands; while Colaba consisted of two separate islands, the smaller of which, then called "Old Woman's Island," he describes as "a dry sandy spot, of no further value to the Company than as affording grass to their antelopes and other beasts of pleasure." Then again the name Umarkadi shows that, when it was bestowed, there was at Mazagon a *kadi*, or salt marshy creek. That it was shallow with a muddy bottom, is further evidenced by the name Paidhoni, given to that portion of the main island at which way-farers, after fording the last creek, washed the mud from their feet before entering the town.

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* Even on the eastern side of the island, however, a very hard black rock is found unlike either the Sewri or Walkeshwar stone. It occurs in small quantities and in isolated spots, which all lie in the same straight line between Sion Hill on the north and Cross Island to the south, showing apparently that it was all the result of one eruption under different conditions than those that formed the other rocks on either side of the island.

This single island of ours then, only two hundred years ago, was a group of at least seven distinct islets, and in the ages before that, ere the work of silting up had progressed so far as it had then, must have been an archipelago of what for the most part were little more than mere island rocks.

But the book we are reading carries their history yet further back. You remember I spoke just now of a dip in the strata at the quarry below Cumballa Hill. Now the same dip you will find, not only in the other ridge on the eastern side of this island, but in Salsette, into which we traced this very rock of Cumballa Hill on which we stand. Not only so, but it is observable in the other islands of the harbour, which together make up the Bombay group. These, with Bombay, would seem then once to have formed one continuous whole.

But the book does not stop there. If you cross the harbour, you will find this same dip on the main land, extending from some hills near Panwel, about 9 miles inland, to the sea, and running longitudinally up and down the coast, a distance of some 130 miles, from some way south of Bombay to near Damaun in the north. It is especially noticeable here, because, with the exception of this small area, the stratification of the neighbouring rocks is for many miles remarkably level, though they are all of precisely the same formation as those that partake in the dip.

Originally, then, it would seem, this island of ours was not an island at all, but a portion of the main-land, and when broken off from that it became a cluster of small rocky islets.

What, then, was the force that broke this fragment from the mainland? Probably the same that produced the dip. That evidently might be caused either by an elevation at the eastern end, or a depression at the western. In the former case, there would probably be some dislocation of the strata about the line of up-heaval. But there is none visible. It therefore seems probable that the dip was caused by a subsidence in the west. But the general subsidence of a line of country near the coast would, of course, let in the sea over the lower portions and round the higher, so as to make islands of what before were eminences on the main-land. These would be further worn down by the action of the weather and the waves, and thus tend to be united into one, like Bombay in her present form, by the deposit about their shores of the silt and sand formed by their own detrition.

But such elevation or depression, as that evidenced by the dip, of tracts of country, is effected only by volcanic agency. It would seem, then, that we owe our insular position to subterranean volcanic forces. How energetic these have been in past times we have abundant proof about us.

If we proceed now to a more minute examination of the rock at our feet, we find that it is heavy, hard, dark, crystalline, and on the flat upper surface curiously marked with a net-work of whitish veins into irregular hexagons. This points to a prismatic or columnar structure of the rock, which, together with its other characteristics, enables us to identify it with the class known to geologists as "basaltic," which are formed by the solidification of ancient lava flows. The columnar structure is not here so marked and general, nor so regular, as at the well-known Giant's Causeway in Ireland, or the Scotch Islands of Staffa and Iona, but unmistakeable groups of hexagonal columns do occur. The most accessible just now is that which overhangs the west side of the Pedder Road, a few yards to the south of the over-bridge at the Parsi Towers of Silence. But even where it is not fully developed in distinct columns, the prismatic structure can easily be traced in many places where the rock has been exposed in vertical section by the operations of the quarrymen. These also disclose the effect of decomposition through the action of the weather, and the percolation of water. First the mass splits into huge cubical blocks like those on the west side of the Queen's Road, just below the ridge of Malabar Hill. These splits take the line of the joints indicated by the network of white lines I have mentioned, which are perhaps formed by the infiltration of light coloured minerals in solution into the cracks caused by unequal shrinkage of the mass of glowing lava while it contracts in cooling. Where these blocks are allowed to lie undisturbed, in such a position as to be exposed to the atmosphere but sheltered from any violent action of the weather, they are found to be surrounded with a red earth, the first result of their decomposition. As you go lower, this pales through orange into yellow, and the rock, further disintegrated by the mechanical action of the water filtering through the soil, as well as decomposed by the chemical action of such salts as it brings down with it in solution, is gradually loosened and broken up till the vertical prismatic columns become spheroidal or oval nodules, consisting of friable layers of a yellowish earthy crust, which you can peel off, like the coats of an onion, round a hard dark coloured nucleus, like the rock at the top. Lower still, even these lose their shape, and you find a mass of rotten brownish "moorum."

Now, if you cross the island to the quarries on the east, you will find the rock, as I have said, not so hard as that on the western ridge, nor does it show the same columnar or prismatic structure. These differences may have been caused by some difference in the conditions under which the mass of molten lava cooled at the different places. In other respects, the rock on the east generally resembles that on the west, both mineralogically and in the manner of its weathering into red earth, and finally decomposing through yellow nodules into brownish moorum.*

The rocky eminences of our island, then, would seem to have been originally formed by outpourings of volcanic lava, and their shape to have been determined by the force and direction of the flow. But these rocky eminences we have already succeeded in connecting with the main-land. You will, therefore, not be surprised to find, on crossing the harbour, that the neighbouring hills of the Concan are also of volcanic origin.

But what is surprising is the immense area and depth covered by the lava flows that produced them. As you go inland from the coast, as you mount the western ghauts, as you cross the plateau of the Deccan, as you scale the heights of Mahableshwar, you find that the country for miles round, on all sides of you, is one great mass of volcanic rock, more than 6,000 feet thick, and covering an area of about 200,000 square miles! With the exception of that which produced the great basalt plain of the Snake River in Western

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*But below this again, on the east side, in the excavations for the extension of the Prince's Dock, at a level which has not been reached at the bottom of the quarries on the West recurs massive rock; apparently identical with that at the top.

North America, covering an area larger than France and Great Britain together, there has probably never been in the history of the world so great an outpouring of lava as that which produced the series of rocks known to geologists as "the Deccan Traps," to which those of Bombay Island belong.

Besides the great depth and area occupied by these rocks, another peculiar feature about them is the extreme horizontality and regularity of their strata. With the exception of that dip in which the rocks of Bombay Island partake, and which we have seen to extend over a comparatively small area, the Deccan traps are found to lie in almost exactly horizontal bands, varying in thickness from 8 to 200 feet, formed by successive flows of lava.

This would seem to show that the vents through which the lava was ejected were raised little if at all above the surface of the ground, and that the lava streamed forth in a very liquid state, possibly as molten mud.

Considering the great area covered by the lava flows, very few of their vents have yet been found. Those which are known, lie principally in the plain of the Concan, and consist for the most part of what are technically known to geologists as "dykes," that is, long lines or walls of basaltic rock, showing that the lava of which it is formed was ejected from longitudinal cracks or fissures in the earth's crust. This, and the fact that the few crater-like vents yet discovered are little more than low hillocks, would seem to confirm the view that the lava flows forming the series of the Deccan traps were poured forth from but slight elevation.

The position of the known vents would seem to point to the conclusion that the scene of the eruptions that produced the Deccan traps was principally in the line of country between the foot of the western ghauts and the sea. There are, however, in Bombay several places to be noticed presently, which doubtless were the foci of volcanic eruptions later than those which formed the Deccan traps. These, as marking weak spots in the earth's crust, may also have been vents for the earlier eruptions, and others, by subsidence of the land, may now be lying beneath the waters of the harbour and the sea outside. However that may be, it seems pretty clear that much, if not all, of that enormous mass of volcanic rock which we know as the Deccan traps was ejected in our immediate neighbourhood from a number of orifices in the surface of the ground, over the edges of which a seething mass of molten mud from time to time welled forth from below.

Now the bottom of this mass of volcanic rock is found to rest on certain strata geologically known as "the Bagh beds," shown by the fossils which they contain to be of marine origin, and identified with the rocks of the "Cretaceous Period" of Europe.

But the lava flows that formed the bottom of the Deccan traps were not deposited beneath the sea. For pent between successive flows, "interstratified" with them, as geologists say, are found strata of mud containing *fresh* water fossils. Moreover, the surface of the Bagh beds, on which the Deccan traps rest, is not all smoothly spread in level lines of horizontal stratification, as we should expect the bottom of the sea to be, but worn into ridges and hollows, as though it had been already elevated to the upper air, and exposed to the action of the weather before the first flows of lava were poured over it.

Again, the fresh water beds interstratified with these show that the first lava flows did not follow each other very quickly, for there was time for them to cool and harden, and by exposure to the weather to be worn into hollows, where were collected the water and mud in which those organisms, both animal and vegetable, that were killed by the next fiery flow passed their lives and were preserved in death.

Here, then, is another important fact recorded in our book. The oldest of the lava flows that form the Deccan traps is newer than the deposit of the Bagh beds, and was itself deposited in such manner as to be exposed to the action of the weather.

But after the formation of the fresh water beds interstratified at the bottom of the Deccan traps, the volcanoes would seem to have become more active, and the flows of lava to have followed each other in quicker succession. For through a great area and depth we find no more fresh water beds, and the bands of lava are found to rest on each other "conformably," as geologists say, that is, the upper are laid continuously and without disturbance on the lower. These facts show that the underlying bands had not been exposed sufficiently long to the action of the weather to be worn into prominences and depressions before the deposit of those lying on them.

But the rocks of Bombay do not belong to this part of the series. For we find here no less than six bands of fresh water beds interstratified with the volcanic rock. Nor do they belong to the older parts in which the other fresh water beds occur. For with the exception of one out of several species of *Cypris*, a small crustacean allied to the "water flea," no animal organism among the fossils of the two sets of interstratified fresh water beds has been identified as common to both.

On the other hand, the fossils of the Bombay fresh water beds belong, apparently, to a later period in the history of the evolution of life on the earth than the others. We find among them the wing-cases of beetles, the bones of a fresh water tortoise, and the skeletons of a small frog (*Oxyglossus pusillus*), which the absence of certain teeth shows to be closely allied to two existing species, *Oxyglossus lima*, found in Siam, China and Bengal, and *Oxyglossus lævis*, found in the Philippines.

Here, then, is another very important record in regard to the age of our island, showing that its rocks were formed towards the end of the series of the Deccan traps, and when those volcanic outbursts were beginning to abate in frequency and violence.

But the Bombay fresh water beds you find on both sides of the island, and they run out into the sea at several places. Moreover, they are continued in Salsette, and, if looked for, would probably be found on the main-land. Wherever they occur they partake in the westward dip we have noticed in the volcanic rocks, the top or latest flows, of which they underlie.

All this tends to show that the fresh water beds were deposited before Bombay was so broken off from the main-land as we have seen, and that they originally extended beyond the present limits of our island. How far beyond, we cannot say, as we have no means now of knowing how much land has been lost by subsidence, by encroachments of the sea, and by the action of the weather.

Now the fossils which we find in the Bombay fresh water beds are such as show that the area which they indicate must have been covered by a shallow muddy swamp of stagnant fresh water.

For there is no trace of any fish, and besides the animal remains I have mentioned of amphibians and reptiles, minute crustaceans and insects, there are two species of fresh water molluscs and vegetable remains, consisting of small pieces of wood and numerous traces of marsh aquatic plants.

It seems, then, that towards the close of the geological epoch known as the Cretaceous Period, the whole of Western India was devastated by such an outburst of volcanic fury as the world has seldom seen. Of course, there were then no human beings on the earth. But, with this exception, the effect of that loosening of the infernal fires may in a measure be realized by the perusal of a very graphic account of a late volcanic eruption in Japan written for the *Cornhill Magazine*, and lately republished in the *Times of India*, from which I will read a few extracts:—

" All around was beautiful on that bright summer morning, when at 7-30 there occurred an earthquake shock so violent as to leave no room for doubt that some mischief was brewing. Fifteen minutes later this was followed by a second and yet more severe shock. Another brief interval of about ten minutes, and the earth began to heave like a tossing sea, rising and sinking, so that houses collapsed, totally wrecked, and people were violently thrown down and became actively sick as if at sea. The earthquake was immediately followed by an appalling and unearthly sound as of the roar of a thousand thunder-claps, blending with the shriek of all the steam-whistles and roaring steam-boilers of earth, and, ere the terrified and deafened human beings could recall their bewildered senses, they beheld the whole mighty cone of Sho-Bandaisan blown bodily into the air, where it overspread the whole heaven with a vast dense pall of ashes and mud-spray, blotting out the light of day and turning all to thick darkness. Ere these had time to fall back to earth, there poured forth dark clouds of vapour and such stifling gases as well-nigh choked all living creatures. Then leaping tongues of infernal flame, crimson and purple, seemed to flash right up to the heavens, and after appalling earth-throes were succeeded by showers of red-hot ashes, sulphur, and boiling water, accompanied by fearful subterranean roaring and rumbling, and by a rushing whirl-wind of hurricane-force uprooting great trees and hurling them afar. Another moment, and there poured forth floods of boiling liquid mud. Evidently the earthquakes must have rent some subterranean fissure, through which a great volume of water suddenly poured into the internal fires, generating a stupendous volume of steam, which must have continued to increase, and so become more and more compressed as volcanic fires and subterranean waters continued their awful struggle, converting the foundation of the mountain into a cyclopean boiler, which finally exploded, with the result, a million times magnified, of the most awful boiler explosion ever known above ground.

"The convulsions of the mountain rent great chasms, from which uprose jets of flame, ashes, and boiling water. The eruptions continued for about two hours. By 10 a.m. its violence was spent, though for hours afterwards the ground trembled and quivered, as well it might after so appalling a fit of passion. But in those two hours the whole face of thirty square miles of country (in the form of a vast fan extending to a radius five miles from the central crater) was totally changed. Of the mountain cone thus suddenly transformed into a steam-boiler, there remains now only the back—a ragged overhanging precipice, rising to a sheer height, variously estimated at 600 or 1,000 feet above a bottomless crater of about a mile in diameter. Thence, with ceaseless roar, rise dense clouds of suffocating sulphurous steam, which sometimes clear off sufficiently to allow adventurous climbers a momentary glimpse of the seething mud below. Those who have ascended that remnant of the mountain from the slope behind it, and so have reached the brink of that precipice have beheld such a picture of desolation as seems scarcely to belong to this earth. All that was Little Bandai now lies outspread in a thick layer of horrid mud, varying in depth from 10 to 150 feet—deep enough to efface every accustomed feature in the whole area—and itself partially coated with layers of pale grey ash and black stones and rocks, which seem to have been ejected to such a height as not to have fallen back to earth until the awful mud-wave had poured itself out. It is now described as a wild chaos of earth, rock, and mud, in some places resembling the concrete blocks of some cyclopean break-water—in others rather suggesting a raging sea whose gigantic waves have suddenly been congealed Of all that made the scene so beautiful and pleasant not a vestige remains—not a blade of grass where lately the mountain was clothed with springy turf, not a green leaf, not a sign of life, nothing but desolation, with a horrid smell arising from stagnant sulphur pools. Great trees, with their trunks twisted and split, lie uprooted and hurled far from the spot where they have stood perhaps for centuries, while of the villages on the mountain not a trace remains—they and their inhabitants lie buried deep beneath this hideous sea of mud."

If such was the scene when 30 square miles of land were whelmed beneath a stream of volcanic mud 150 ft. thick, flowing from a single crater, try to imagine what it must have been when with scores of lava vents in full operation, the same calamity occurred over a space 700 times as large, not once or twice only, but at intervals extending over many years, till the wide territory subjected to it was buried 40 times as deep as the fair fields of Bandai.

Even when the land began in a measure to recover from the effects of these outbursts in the intermissions of their fury, and plant and animal life was again developed on its surface, again and yet again the deadly torrent burst forth, overwhelming in sudden death the young beginnings of life that had just struggled into existence.

In this way were piled up on the main-land new hills of lava on the site of the swamps that filled the depressions worn by the weather in the surface of the flow that last preceded them.

But even when these were cooled and solidified into rock, volcanic fires still broke forth at intervals. For we find at several places in the island, notably Sion, Sewri, and Bhandarwara, as well as at the hill in which are excavated the Kanheri Caves in Salsette, and even at the bottom of the harbour in the tideway outside the Prince's Dock, masses of volcanic ash embedding fragments of the older volcanic rock torn off in the later eruptions, which are seen in places to have broken through the strata of volcanic rock and fresh water beds alike.

Then came the subsidence of a whole tract of country that plunged the western extremities of the continent beneath the waves, and cast her hills into the sea to become a cluster of island rocks.

Now turn another page of the record at our feet. You remember we saw the soil of the Flats, which form the centre of our island, to consist in part of estuarine clay, and in part of marine sand. The former must have been deposited when Bombay was a group of islands separated by tidal creeks, such as we see to this day in abundance about Salsette and the coast of the Concan. It contains numerous roots of mangrove bushes bored by a species of teredo, showing that the soil in which they grew was a muddy salt marsh half way between high and low water marks. The marine sand, in places caked together into compact masses, to which the name has been given of "littoral concrete," consists almost wholly of sea shells that lived below low water mark. But, where both are found together, the low tide sand is found *above* the half tide clay, and in this order both are found together in places above high water mark.

But this is not all. At a spot in Byculla, 20 feet above the level of the sea, has been found below the clay that underlies the littoral concrete, a band of brown earth, evidently a salt water deposit, for it contains nodules of lime enclosing shells of the thin oyster, which from its position must be older than the blue clay, but from its appearance must have been exposed to atmospheric weathering.

Here, then, is another strange fact recorded in our book. After the volcanoes had so piled hills as we have seen on the fresh water swamp on the main-land, and these had by a subsidence of the coast been broken off the main-land and cast into the sea as islands, and had there lain undisturbed long enough to allow the deposit of the silt which forms this band of brown earth, there came an upheaval of the land that raised the floor of the sea above high water mark and exposed it to the action of the weather. This was followed by another subsidence that brought the band of brown earth below the level of half tide mark long enough to allow the deposit on it of the mud of tidal creeks and the growth of mangrove forests. Then again the land sank down, till what had been salt marsh became deep sea, and on the estuarine clay was deposited the shelly sand of the littoral concrete. Then another change, this time an *up*-heaval, and lo! brown earth, blue clay, and littoral concrete, are together pushed up *above* the level of the highest tide!

This change in the level of the Flats, for a reason I shall presently point out, probably pushed them up considerably higher than they now are, and possibly connected all the rocky islets in one. If so, there must have been another subsidence. For, as we have seen, Dr. Fryer, 220 years ago, found the island no longer one. If that subsidence is still continuing, as seems not improbable, we would appear to be on the way to being slowly submerged, and are doing our best to aid the efforts of nature in this direction by cutting down all our hills! On the other hand, if the waters around us are not being deepened by a subsidence of their floor, we are in danger of being silted up by mud and sand, if not lifted bodily back on to the mainland by another upheaval. In either event farewell to Bombay's greatness as a maritime port, even if she escapes destruction by another eruption, the possibility of which is at least indicated by her past history, and these continual upheavals and depressions, which can only be the work of volcanic forces!

But, as the novelists say, I anticipate. Besides, I am wandering away from my subject, which is connected with Bombay only in the past tense, not in the paulo-post-future.

To return to the last upheaval that brought the shelly sand of the ocean's floor to the surface of the dry land, that it occurred in what geologists (whose computation of time is not by years, but by cycles of ages) call "recent" times, is shown not only by the fact that the shells of the littoral concrete are such as we find on our shores to-day, but that in the brown earth which underlies the clay below it are found unmistakeable traces of human occupation. This brings us to the last page that has yet been opened of our unwritten history, where we find traced in clear characters the word "Man," which makes the facts recorded on it, though not so surprising as some we have already learned, yet, perhaps, of more personal interest to us.

Some twelve years ago, while the excavations were being made for the Prince's Dock, Mr. George Ormiston came on the remains of what was evidently a submerged forest, 32 feet below high water mark. Nearly 400 trees in all were found, of which 223 were still standing erect, and 159, though prostrate, were still rooted in the soil. This was a shallow band of brownish earth, apparently identical with that which we have seen to exist at Byculla, for it seemed to be of marine origin, but altered by atmospheric weathering, and immediately underlay the blue estuarine clay in which the trees were buried, and overlay the trap rock. The trees were all a species of acacia (*Acacia Catechu*), known to the natives as *khair*. It, of course, never grows at any spot below high water mark, and is now found in great quantities in the jungles about Badlapur, on the lower spurs of the western ghauts, at a considerable elevation above the sea.

Here, then, is a very clear record of a decided upheaval and subsequent subsidence. Judging too from the nature of the trees found in it, it would seem that the brown earth deposited by the sea must have been pushed up considerably higher than the present level of the littoral concrete which overlies the blue clay above, and have been allowed there to rest undisturbed for a time sufficient to allow the growth of these trees, the largest of which was 46 feet long, and 4 feet 8 inches in girth.

Then followed a subsidence sufficient to allow of the trees being completely covered by the muddy silt of the harbour. This was apparently effected rapidly, but without any great or sudden rush of water. For all the fine twigs were found preserved in position in the clay, the lower portion of which contained no shells, as the upper did,* while the borings of the teredo worms that had perforated the standing trunks were found to extend for only about a foot downwards, and the rat-holes at the roots of the trees, though filled with mud that exactly preserved their shapes, yet contained no remains of drowned or smothered rats.

None of the trees bore any marks of having been felled or cut, but among them was a log certainly charred by fire. The burnt portion showed by its shape and position that it had been laid with its centre across the fire. What the makers of the fire were doing there does not appear. Certainly not cutting wood, though they might have been gathering the pods to get catechu, if its properties and uses were known to them. Nor do they seem to have been permanent dwellers on the spot. For except the charred wood, apparently the remains of a camp fire, there was no other trace of human occupation.

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*This shelly upper portion is also much darker in colour, and very offensive in smell, so much so indeed that on being first dug into, both at the time of the first excavation of the Prince's Dock and of its subsequent extension, many of the workmen sickened, and fever was very prevalent among them. Apparently the upper or later part of this clay deposit was charged with the sewage of the city, which, since the construction of the railway embankments at the north end of the harbour, has been deposited more rapidly and in greater quantities than when the openings there allowed a through "scour" in a free passage for the sweep of the tide and the creek currents round the north of the island.

Possibly they were a party of belated fishermen or oyster-catchers spending the night in the shelter of the trees, which, though they may have been at a considerable elevation above the sea, were certainly not far from the coast, for on the gravel in a crevice of the rock was found an oyster shell.

Again, when fresh excavations were being made by Sir Thomas Thompson last year for an extension of the docks, two or three more trees were found, among which was another log, charred much in the same way as the first. These are, however, eclipsed in interest by a specimen which Sir Thomas has kindly lent me for exhibition to-day. It is one of two covered stone jars† found on the level of the soil in which the trees were rooted.‡ As they were standing right side up with their covers on, it seems unlikely that they were dropped from a passing boat. If not, they prove conclusively the presence of man on the spot at the time the submerged forest was above water. The man, however, was not far advanced in civilization, or his jars would have been of pottery or metal, or, if of stone, more smoothly finished. Nor does he seem to have been a permanent inhabitant of the place. For there are no other traces of his occupation than the remains of this fire and his two jars, and the stone of which the latter are made, though doubtless of volcanic origin, like almost all the stone for hundreds of miles round, differs in colour and texture from any found in Bombay.

Here, then, are traces of another, or perhaps the same, party of occasional visitors, who, on going away, forgot to take with them some of the utensils they had brought. These bear no signs of fire, and could not, therefore, have been used for cooking. Their weight is so great in proportion to their capacity, that I doubt if they were intended to be used as receptacles for articles to be carried any great distance, and they are too small to have been used for storing. Moreover, when found, they contained nothing but mud. It seems then they were intended to hold something easy of consumption, or difficult of preservation, not intended to be carried any grêat distance. They might, therefore, have contained the food or drink of some person paying a short visit to the uninhabited island from some neighbouring place. That no traces of such visits are found elsewhere than close to the eastern shore, would seem to show that the object of these prehistoric picnicers was the capture of fish or the collection of oysters, and that they came from the East.

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† These jars were nearly spherical in shape, but with flat bottoms, roughly hewn and hollowed with some narrow angular pointed tool, the marks of which were not smoothed off. The covers were stopper shaped and fitted loosely in the mouths.

‡ So I was told by Sir T. T., but this seems to be a mistake, for I was told by Mr. Ormiston, after the delivery of my lecture, that Mr. Lynn, the Engineer, pointed out to him a spot in his plan and section of the works as the place where the pots were found, from which it would seem they were lying only a foot or two below the top level of the blue clay, and must therefore have been buried long after the subsidence, and were probably dropped from a passing boat. This does not, however, detract from the evidence of the charred logs that the subsidence took place in the Human Period, or tend in any way to show that Bombay itself was then permanently inhabited by men.

Shortly, then, to sum up what we have spelled out from the pages of our ancient book, we find that the spot on which we stand, and which we are fond of speaking of as "*Prima in Indis*," is in fact one of the *last* made, and *last* inhabited. For we have seen that the rocks immediately around us were the latest fashioned on these coasts. We have seen how the foundations of our thriving city, now so picturesque and pleasant, were laid in scenes of desolation and death, amid the horrors of heaving earthquakes, when the land was rent by the fury of volcanic fires, and swept of life by glowing lava floods. We have seen how these were followed by brief intervals of peace, in which the earth, all scarred and shaken as she was, strove once more to clothe herself in her mantle of green, and sustain the young life of her new-born creatures on her bounteous bosom; but how these were again and again engulphed in fiery death, and buried in successive flows of molten rock, that piled rows of bare arid hills on what had been a level fresh-water plain, a dreary swamp perhaps, yet teeming with vegetation and life. We have seen that when the destroying flood abated, volcanic fires here and there yet broke forth anew, and that the subsidence of more than 1,000 square miles of land upon the coast, perhaps by another effort of the Fire Demon beneath the earth, plunged the mountains of the main-land as islands in the sea. We have seen how this archipelago of rocks, though peopled by no human inhabitants of its own, even after the appearance of man upon our globe, was yet trodden at times by the chance steps of stray visitors from other shores. Lastly, we have seen how, after being alternately lifted and lowered by successive upheavals and subsidences of the ocean's bed, a group of islets was at last joined in one by the banks of soil and sand furnished by their own waste, and Bombay, as a single island, rose as did of old the Goddess of Beauty, from the sea.

Am I not right in saying that a book in which we can read such tales as these is one whose every page is full of interest for us all? And does not a tale such as that we have just read prove how true was the word of him whose every word is truth, when he spoke of the "sermons in stones, and good in everything?"

But let me ask you to remember this. Ours is a book that he who would understand it aright must read with his own eyes, and ponder with his own mind. No disquisition, however clear, by any geologist, however able; no picture or plan by any draughtsman, however skilled; no lecture a hundredfold more learned and eloquent than this of mine; can teach you one tithe of what you can teach yourselves, if you only go afield with a humble and steadfast purpose to learn, and study the scenes around you for yourselves.

THE BUTTERFLIES OF THE CENTRAL PROVINCES

By J. A. Betham.

(*Continued from Vol. V., page* 28.)

Before enumerating the butterflies found in the Central Provinces. I would here state that the number in brackets, which will be found after the name of each butterfly, is that given to those which are described in Mr. de Nicéville's book, "*The Butterflies of India, Burmah and Ceylon*." If a description of any butterfly is required, all that has to be done is to turn to the number in the book, and there a very ample, correct and lucid description of the butterfly, with notes (in most cases) as to its habits, &c., &c., will be found. The few notes I am able to give are chiefly from personal observation of those butterflies that I have come across.

SUB-ORDER—RHOPALOCERA.

FAMILY—NYMPHALIDÆ.

SUB-FAMILY—*Danainæ*.

1. *Danais melanoides*, Moore (see *Danais aglea*, *Cramer* [16].—Of this butterfly I have as yet only one specimen, a male, taken at Jagdalpur, the capital of the Bastár Feudatory State. It has semi-transparent wings, very pale blue with black veins.

2. *Danais limniace*, Cramer [26.].—This butterfly, with *D. chrysippus*, *D. genutia* and *Euplœa core*, is very common, is found everywhere, and can be taken nearly all the year round. It has pale blue wings with black veins. The wings are not so transparent as are those of the last-named species. It is a rather large insect, and has a lazy, sailing flight. The male has a pocket or scent-pouch in the hindwing, and protrudes from the anal extremity of the body two processes of a greyish colour which resemble bottle-brushes in miniature. When this is done an odour is perceptible. No doubt this is a provision of Nature to protect it from its enemies. It is a most difficult insect to kill, as are most of the *Danainæ* and *Euplœinæ*; a squeeze, such as would crush the life out of such a strong-bodied creature as a *Charaxes*, has no effect on it, its body is so leathery and tough. The best way of killing it, as far as I have had experience, is to put a drop or two of benzine on its body. It is easily captured, seemingly having very little fear of human beings. It is imitated more or less closely by several other species of butterflies, the ones most common in these parts being *Papilio dissimilis* and the female of *Nepheronia gæa*.

3. *Danais chrysippus*, Linnæus [28] with varieties *D. alcippus*, Cramer [29] and *D. dorippus*, Klug [30].—The typical *D. chrysippus* is the commonest and most widely spread of all butterflies in India, or at any rate, the one that strikes the eye more than any other. *D. alcippus* and *D. dorippus* are, I believe, only forms of *D. chrysippus*. During the time I have been in the Central Provinces (now nearly

14 years) I have only procured one specimen of each of these varieties; of the former I caught one in the public gardens at Betul in 1886, and of the latter one at the Marble Rocks near Jubbulpore, in the same year. I have a few specimens of what are undoubtedly *D. chrysippus*, in which the black coloration at the apex of the forewing is more or less obsolescent, and the red ground shows through; the gradations between this and the commoner form are almost complete, and pass from the deep black at the apex of the wing of the typical *D. chrysippus* through others in which the red begins to show through, till in some forms the red predominates and the black consists merely of a border. If either *D. alcippus* or *D. dorippus* were a distinct species, it would be found more generally distributed, and there would be no gradation from the type to the variety, the difference would be sharply marked and distinct. It may be that they are "sports" or "aberrations," as are albinoes or melanoids among human beings and other creatures. I have other butterflies which present something of the same variation, for instance, a male *Nepheronia gæa*, in which the black border to the wings is about twice as broad as it is in an ordinary specimen, and a female *Ixias marianne* in which the black border of the hindwing suffuses nearly the whole of the wing, nearly obliterating the white, although the same wing on the left side has the border of the normal width. *D. chrysippus* is the common tawny-red butterfly which one sees almost everywhere, and almost always, with a black apex to the forewing, behind which is a white band. It has a lazy flight and is easily caught. In some favoured spots they swarm in hundreds. The air seems full of them, and they can be seen settled holding on to the extreme ends of twigs or along them, thus trying to make one believe that they are dead leaves. These places are generally warm, dry spots under the shade of large trees. Various other butterflies among the *Danainæ* and *Euplicenæ* have the same habit. They are as difficult to kill as the last; a drop or two of benzine on their bodies, however, soon stops their struggles. *D. chrysippus* is more or less closely imitated by several other butterflies, the most wonderful being the female of *Hypolimnas misippus*. Col. C. Swinhoe, in one of the former numbers of our Journal (Vol. I., page 169, *et seq.*), has given some interesting remarks on this instance of mimicry.

The caterpillar of this butterfly feeds on the Madár (*Calotropis gigantea*). It is well described by Mrs. Hart in her "Notes on a Caterpillar Farm," Vol. IV., page 285, of our Journal. The pupa, which is suspended by the tail, assumes two colours, some being a delicate green, and others an equally delicate pink, as if made of wax; they have a thin black and yellow rim around the thickest part.

4. *Danais genutia*, Cramer [31].—This butterfly is almost as common as the last, and has the same habits. Its colouring is very similar, only that the veins are more broadly marked with black. The males of both this and the last have a scent-pouch in the hindwing. It loves to congregate in large numbers, as does *D. chrysippus*. On the average this insect is larger, and, I think, handsomer than its relative. It is imitated by the female of *Elymnias undularis*.

5. *Euplœa linnæi*, Moore [56].—I have only one specimen of this species, a male from Jagdalpur. It is very much smaller than specimens from Assam, and that is all I know of it, for I have never seen it in life, and the one I have was taken by a native collector. There is some little doubt about the proper name of this species, and it is usually referred to as *E. midamus*. Mr. Moore identifies the latter with a distinct butterfly occurring in China.

6. *Euplœa core*, Cramer [61].—This rivals *Danias limniace*, *D. chrysippus*, and *D. genutia* in its general distribution. It is a deep brown, almost black in colour, with a white border to its wings. Its flight and habits are very much the same as the butterflies already described, but perhaps it loves the shade more. It is easy to capture, difficult to kill, and the male has the power of protruding two yellow bottle-brush like appendages from the end of its body. I have specimens without the spots in the cell of the wings, and I once took a specimen which had the spots in the cells of both fore and hindwing on one side but not on the other. Several butterflies resemble *E. core* in colouring, among which may be mentioned *Papilio panope* and the female of *Hypolimnas bolina*.

The caterpillar and pupa of this butterfly are also described in Mrs. Hart's paper, Vol. IV., pp. 284 and 285. The food plant is usually the Oleander (*Nerium odorum*), but last year I found four of the caterpillars feeding on the leaves of the Pipal tree (*Ficus religiosa*). I was successful in rearing all four until they reached the imago.

stage, when I set them free. This must be their real food plant, as it is indigenous and the Oleander is an introduced plant. I do not think this has been recorded before.

SUB-FAMILY—*Satyrinæ*.

7. *Mycalesis medus*, Fabricius [92].—This is the rains form of *M. runeka*, Moore [93], as Mr. de Nicéville has proved by breeding from one to the other and *vice versâ*. *M. medus* differs from *M. runeka* in having the white streak on the underside less prominent but the ocelli much more so; in *M. runeka* they are small and obsolescent. Their colour on the upperside is a uniform dark brown, with an ocellus on the forewing in some specimens. These little butterflies are shade-lovers, and lie hidden under the trees and bushes during the day-time; they are active and restless in the morning and evening, and also when the day happens to be dark and cloudy. They possess some curious and distinctive features. The costal nervure is dilated at the base of the forewing in both sexes. This nervure does not touch the costal or upper edge of the forewing, but lies some little distance behind it. The males have tufts of hair on the hindwing. They have a skipping kind of flight when started from the shades they love; they are, however, easily caught and killed.

8. *Mycalesis blasius*, Fabricius [96].—This is the rains form of *M. perseus*, Fabricius [99], but one would think it to be a quite different butterfly. *M. blasius* has well marked ocelli and a distinct white fascia on the underside of both wings, whereas in *M. perseus* these are almost obsolete, though in some specimens of the latter there are well marked spots in the position of the ocelli which are on the wings of the former. There is a great deal more variety in the markings on the underside of the wings of *M. perseus* than there is in *M. blasius*. The apex of the forewing in *M. blasius* is a uniform dark brown, not so dark as in the last described species, but in *M. perseus* there is always a small ocellus on the forewing. The veins at the base of the forewing are swollen in both sexes and the eyes are hairy. The males have an erectile tuft of hair, and a glandular patch on the hindwing. These features are also present in the two next described species. Its habits and flight are very

similar to those of the last described species, but it is a much commoner butterfly.

9. *Mycalesis mineus*, Linnæus [97].—This is the rains form of *M. visala* [99*a*] and *M. indistans* [99*b*.] of Moore. It is larger than the last species and is not so common. To me it seems a paler insect altogether, and with a sharper angle to the forewing than has *M. perseus.* Its habits and flight are the same as the foregoing.

10. *Mycalesis malsara*, Moore [108].—This is the rains form of *M. rudis*, Moore [110]. I have taken very few specimens of these two forms; in fact, I do not think I have yet procured *M. malsara.* It is also a dark brown insect; but the underside has a redder tinge than those described before. All these insects love the shade, and the way to discover them is to beat the bushes so as to disturb them.

11. *Lethe europa,* Fabricius [135].—This is also a shade-loving insect, but is easily procured in the evening, as are all *Mycaleses* and *Melanites* at sugar. They are all also very fond of mhowa refuse after the spirit has been extracted from the flowers. Mhowa spirit is made from the flowers of the Mhowa tree, *Bassia latifolia.* The flowers are semi-transparent globular objects when fresh, and are eagerly sought after by many kinds of birds and beasts. They appear in February and March, and drop off in the early morning, so that, if you are encamped under a mhowa tree, you are awakened by a continual patter on the top of the tent as the flowers shower down. The people who collect them have to get up early, as one has to do at home when on a mushroom-gathering expedition, otherwise the cattle, jackals, bears, pigs and all the deer tribe would not leave one behind. The flowers are collected in baskets, taken home, dried, and then used up as required by the Kalars (spirit distillers). Before the spirit has been extracted the flowers do not seem to possess such an attractive power for insects, but as soon as this is done, and the refuse cast outside, various beetles and butterflies are attracted to it. I suppose the fact of there being something spirituous about it is the cause. I have found that the attractiveness of the refuse is much increased by the addition of "gur" or "jaggri" (coarse country sugar), melted till it is like treacle, and of a little rum, or else the mhowa spirit itself; a small quantity of this put out proves an irresistible bait for *Satyrinæ* as well as various species of the

Nymphalinæ. It is good to attract other insects as well, and I advise entomologists to try it. *L. europa* is a beautiful insect, with its lovely mottlings and markings, especially on the underside. It is shy and easily scared. The costal nervure is swollen at the base, and the eyes are hairy. The female is larger and more conspicuous than the male, owing to the presence of a white band across the forewing.

12. *Lethe nilgheriensis*, Guérin [104].—This looks like a small edition of the former, but lacks the white band across the forewing in the female. This is replaced by three oval white spots ; its habits and structure are the same as those of *L. eurona.*

13. *Ypthima philomela*, Johanssen [204].—This the rains form of *E. marshalli*, Butler [205].—All the *Ypthimæ* are small obscurely coloured brown butterflies, with ocelli on both sides of the wings, and striæ on the underside. They are generally found fluttering about where there is grass, and flying in and out amongst the stems ; they are feeble little things, and not difficult to capture.

14. *Ypthima ariaspa*, Moore [212].

15. *Ypthima asterope*, Klug [213].

16. *Ypthima inica*, Hewitson [214].

17. *Ypthima singala*, Felder [222].

18. *Malanitis leda*, Linnæus [243].—This is the rains form of *M. ismene*, Cramer [249.] Both varieties are very common under bushes and in dark places. Where there is shade and moisture you sometimes come upon scores, and the bushes have only to be disturbed, when they will show themselves. They rise in so great a hurry that they knock against leaves, bushes, tree trunks, anything in fact until they rest again, and then it is a difficult matter to find them. Their colouring is a subdued yet rich brown, with a black mark on the forewing, larger in *M. ismene* than in *M. leda.* There are two or three white spots on these black marks, which former are bordered more or less continuously with ferruginous. *M. leda* has beautiful ocelli on the underside, while in *M. ismene* these can hardly be seen ; all the same, when once settled on the ground, they so closely resemble dead leaves that the sight has to be keen to detect them. *M. ismene* is altogether a larger and brighter coloured insect than *M. leda,* and the underside of the former presents the most varied patterns in

russets, browns, subdued yellows and greys. No two that I have seen are exactly alike. Some are most lovely in their rich variety of tints, while others are pale and insignificant looking. They are crepuscular in their habits, coming out in the evening and dancing about like elves, as has often been described. The singular habit they have of mounting into the air until lost to sight has some reason for it no doubt, but what that reason may be has not been discovered. They are gluttons for sweetened mhowa refuse, and can be caught with the fingers while feeding on it. They, as well as *Mycaleses* and *Lethes*, are fond of ripe fruit: a guava on the verge of rottenness has a great fascination for them. They can also be easily caught when drinking toddy, and many other butterflies share this taste. You can often find many at the foot of the palms that have been tapped, and from which the juice drops down to the ground. The shape of the wing in *M. ismene* is more falcate or sickle-shaped than in *M. leda*. They are easily caught if they can be detected on the ground.

M. leda is a smaller butterfly and not so highly coloured as *M. ismene*, and appears during the rains; while *M. ismene* comes out during the dry season. One would suppose them to be different butterflies altogether, but this is not the case; they are only seasonal forms, as Mr. de Nicéville has proved by breeding one form from eggs laid by the other form. Various other genera of the *Satyrinæ* present the same phenomenon, and as a rule those that appear during the rains are smaller, with more even wings, and the ocelli on the underside more prominent; whereas those that appear during the dry season are larger, with the outline of the wing more varied, and the ocelli obsolescent. It would appear the reason is that during the hot months the caterpillars find it difficult to procure sufficiently rich proper food, and so the result is a smaller and less highly-coloured butterfly, while in the rains the supply of food is ample, and the result is a more highly-coloured and larger butterfly. I have reared the caterpillar on the blades of green rice during the rains. It is green with a longitudinal yellow stripe and a curious forked tail. The pupa is green and suspended in a sort of slight cradle made of the blades of rice.

19. *M. bethami*, de Nicéville.—A description of both the dry and

rainy season form of this butterfly appeared in the Proceedings of the Zoological Society of London for 1887, pp. 451—453. It is a larger and more deeply-coloured butterfly than the last, but has the same habits. It has only been found about Pachmarhi, 3,500 feet, a sanitarium in the Satpura Hills, where it is fairly abundant.

SUB-FAMILY—*Elymniinæ.*

20. *Elymnias undularis*, Drury [256].—This is also a shade-loving insect with a feeble flight. The differences between the sexes is most marked. The male is a dark brown insect with blue markings on the forewing, and a reddish tinge on the hindwing, while the female imitates *Danais genutia*, being of a reddish-brown colour with black and white markings. The undersides of both sexes are the same, or very nearly so. They are fond of settling on the stems of plants and on tree trunks.

SUB-FAMILY—*Acræinæ.*

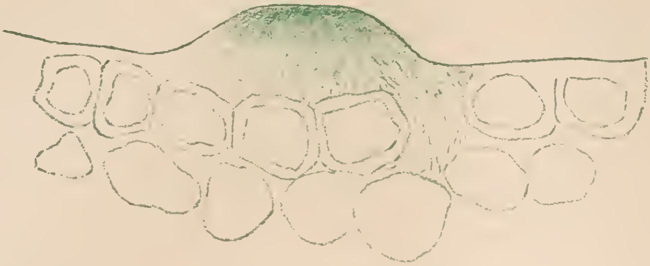
21. *Telchinia violæ*, Fabricius [298].—A small reddish-coloured butterfly with black veins to its wings, like a miniature *Danais dorippus.* It has a very tough and leathery body, and is difficult to kill but easy to capture. It is very common in many places in the Central Provinces, and seems to delight in bare, arid places, although plentiful too in moister spots.

The caterpillar is a blackish-coloured creature, and feeds on *Cucurbitaceæ.* The pupa is a very pale pink with black marks.

SUB-FAMILY—*Nymphalinæ.*

22. *Ergolis merione*, Cramer [299].—A fairly common butterfly in many parts. The caterpillar feeds on the castor-oil plant, and the egg is covered with hairs or spines. The upperside of the imago is a tawny-brown with delicate black markings, and the underside is much darker, appearing quite black when the butterfly is flying. It settles with its wings expanded, has a slow jerky flight, and is not difficult to capture. It has a swollen costal nervure to the forewing.

23. *Ergolis ariadne*, Linnæus [301].—This is very like the last, but is smaller, and can be distinguished by its having the edges of its wing more scallopped, or " pinked," as the ladies would say. It has also two of the veins of the hindwing on the upperside white



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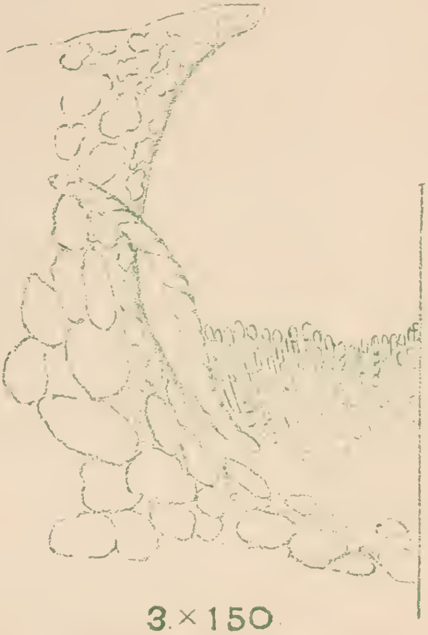

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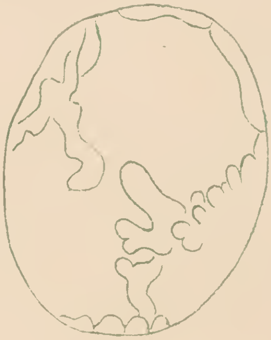

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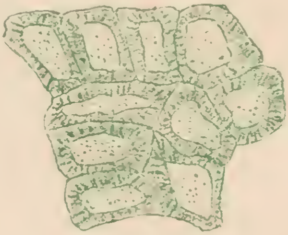

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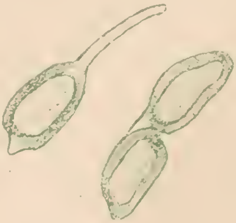

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AECIDIUM ESCULENTUM, NOV. SP.

and shining. Its habits and manner of flight are very much the same as the last.

24. *Byblia ilithyia,* Drury [303]. This butterfly is a brighter-coloured one than the last two. I have only taken it in the Hoshangabad district, where it is fairly common. The costal nervure of the forewing in this genus is also swollen, as in *Ergolis*.

25. *Atella phalantha,* Drury [314].—A very common but beautiful little butterfly. It is wonderfully sharp and active in its movements. It looks for all the world like a fritillary with its bright rust-red wings, and black markings. Underneath, when fresh, it has pearly iridescent tints. The head and eyes look larger in proportion to its body than is the case with most other butterflies. It is fond of the sunshine, and perches in exposed situations, sallying out to fight with any other butterfly that comes along, and then returning to its old perch.

26. *Precis iphita,* Cramer [343].—A glossy looking butterfly, in shape almost the same as the *Junoniæ* that follows. It is fond of shady woods, but has the habits of most of the *Junoniæ* in its quick manner of flight. I have only come across it in three or four places in the Central Provinces, but where it occurs it is fairly common. It is fond of settling on the ground, and like a *melanitis* is difficult to distinguish from faded and fallen leaf.

DESCRIPTION OF A NEW FUNGUS, ÆCIDIUM *ESCULENTUM, NOV. SP. ON ACACIA EBURNEA,* WILLD.

By A. Barclay, M.B., Bengal Medical Service.

This Æcidium is one of considerable interest, not only on account of the largeness of its effect upon the host bearing it, but because it is only the second species of Uredine which, so far as I am aware, is known to be eaten by human beings. The large hypertrophies caused by *Æcidium Urticæ.* Schum, *var. Himalayense,* on the common nettle of the outer Himalayas (*Urtica parviflora,* Roxb.) are eaten raw, as I have myself seen, by the poor people on account of the large amount of nutritious material stored therein by the mycelium of the fungus*; but in the present case the pure fungus itself is apparently eaten, and after some elaborate preparation, as I am informed by Mr. Wroughton, to whom I am much indebted for the kind trouble he has taken in sending me specimens. I first received a small specimen of the fungus from Dr. Cunningham, F.R.S., in August, to whom it had been sent, through Mr. Cotes of the Indian Museum, Calcutta, by Mr. Wroughton. This had been gathered at Poona, but as the specimen was insufficient in many respects for any useful description I addressed Mr. Wroughton, begging him to send me other specimens, and for any general information he might be able to gather concerning it. To this he responded most generously, and all the information this paper contains, other than the more diagnostic characters of the fungus, is his.

There was at first some doubt concerning the botanical identity of the host, but Mr. Wroughton has convinced himself that it is undoubtedly *Acacia eburnea*, Willd, and known to natives as Mūrmūti. In certain areas of the Poona district the fungus is most common, every tree or bush being covered with it; and it occasions such distortion and dwarfing of the host that attacked trees may be recognised from a great distance. The parasite appears to distort the stem much as the mistletoe does the stem on which it grows. As Mr. Wroughton says, "it is fortunate that *A. eburnea* is of no value as a timber tree," as otherwise the presence of the parasite would undoubtedly give rise to much loss.

The specimens I received showed, even on cursory inspection, that the parasite had a generally pervading and probably perennial mycelium, and that the presence of this mycelium caused an excess of longitudinal growth in shoots, with very considerable hypertrophy or thickening. Dr. G. King, F.R.S., writes of specimens he received:— "It is curious to notice how the capitate heads of the Acacia become elongated when attacked by that curious fungoid growth.* * * Anybody examining such diseased heads and not seeing the healthy ones would at once refer them to some of the set with spicate infloresecnce." The fructification of the fungus is always found at the ends of flowering shoots and not generally on the larger shoots. This consists mainly of an immense number of *æcidia* (*peridia*) dotted thickly over the younger attacked parts of the host. They are bluntly conical bodies about 1 m.m. in height and 1 m.m. in diameter.

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* Sc. Memoirs by Medical Officers of the Army of India, Part II., 1886

Before proceeding to a detailed description of the fungus. I may here note that it is apparently these Æcidia which are eaten. They are readily scraped off the host. As I understand it, these *æcidia* having been scraped off are boiled until quite soft, and when cold are rubbed up into a mess with spices and then warmed up and eaten as a relish. Mr. Wroughton writes—" I find all the people eat it freely."

The first specimen I got through Dr. Cunningham; if collected immediately before it was sent to him, must have been gathered in July or early August, and the next specimen I got direct from Mr. Wroughton was gathered on the 11th January. Each specimen contained ripe *æcidia*; but I have no definite information as to the seasons during which the ripe *æcidia* are found, and during which they are absent. From the last specimen sent to me in alcohol it would appear that the *æcidi* are produced during the time the host puts forth new shoots; this may be once or twice a year. With these introductory remarks I proceed to a systematic description of the fungus.

The *mycelium* apparently pervades every tissue of the parts attacked, and gives rise to considerable hypertrophy of the parenchymatous cells. From this it may be concluded that the mycelium is perennial. It would, however, be interesting to know whether the parts which have once borne *æcidia* die after this, new shoots from its neighbourhood only being attacked in the next season of vegetative activity, or whether they again bear another crop of *æcidia*. It is in the highest degree probable that the former is the case. The *mycelium* itself is of the ordinary kind common to these parasites, but is characterised by the formation of innumerable *haustoria*. These are either button-like intrusions into the cell cavity (as in the Peronosporeæ and Ustilagineæ) or simple tubes. Sometimes a grape-like mass of button-like *haustoria* may be seen within a cell (fig. 1, Plate A).

Before the *æcidia* are formed numerous *spermogonia* cover the surface of attacked parts. These are remarkably small and superficial (fig. 2 Plate A.) being superficial to the epidermis. They are flat, circular bodies, measuring from 100 to 120 μ in diam. and 30 to 40 μ in height. They are of the usual structure and call for no special description.

The *æcedia* as already noted are bluntly conical bodies, about 1 m.m. in height above the host's surface, and 1 mm. in diameter. They are very deeply set, the basidial layer being about 0·378 mm. below the outer surface of the epidermis. The basidial layer is very regular and flat, and beneath it is a large mass of convoluted hyphæ (fig. 3, Plate A.)

The *peridium* is very resistant and tough, but is composed of a single layer of flat angular cells (fig. 4, Plate A), Each cell is bevelled both above and below like the edge of a chisel; the bevelled edge of the upper end overlapping the cell above *externally*. The outer surface of each cell is thickened. The thickness of the peridial layer is 20 μ.

The *æcidiospores* are extremely numerous within each peridium. They are given off in very long rows, the lowermost being extremely small, and indeed look like the stalks of *teleutospores* septated (fig. 3, Plate A). Not having seen any fresh specimens I am not aware of the colour of the ripe spores. In order to obtain the following characters of the ripe spores, I first placed fragments of the host bearing ripe but unopened *æcidia* which had been hardened in alcohol into a mixture of equal parts of alcohol and glycerine for 24 hours, and then into pure water for 24 hours. After such treatment the spores were found to be light brown in colour, irregularly oval, but varying in size and shape, and tuberculated or slightly spiny on the surface. They were found to be thickened at one end, with usually a small, but sometimes unusually long (fig. 5, Plate A) projection. These projections apparently aid in keeping some spores of a series together (fig. 5, Plate A). They measured 28 to 40×16 to 19 μ. Each spore appears to have two germ pores.

Such then are the characters of one stage of existence of a very remarkable *Æcidium*, and I would commend a study of its life history to the members of the Bombay Natural History Society as a research very promising in yielding fruitful result. So far it will be observed no resting spore in connection with it is known. This must be sought for either on the same host, or some other widely different from it. As the parasite has apparently a perennial *mycelium* allowing it to reproduce the stage I have described, year after year, it is possible that the resting spore stage may be rare, but reasoning from analogy this other still undiscovered stage is probably abundant.

This apparently is a new species, and I have named it *Æcidium esculentum* to indicate its edibility, a rare property in this group of fungi. In a list of all the known *Uredineæ* published lately by Dr. P. Dietel* two species of Æcidium on species of Acacia are noted, one *A. inornatum*, Kalchbr., on *A. horrida*, L., and another *A. ornamentale*, Kalchbr. on *A. Farnesiana*. As I have no access to descriptions of these, I cannot definitely state that the species I have just described may not be identical with one or other of these; but the probability is that it is distinct, since neither of these hosts exists in India.

Simla, 3rd February 1890.

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* Verzeichniss Säintlicher Uredineen, Leipzig, 1888.

NOTE ADDED TO Dr. BARCLAY'S PAPER.

By Dr. D. Prain.

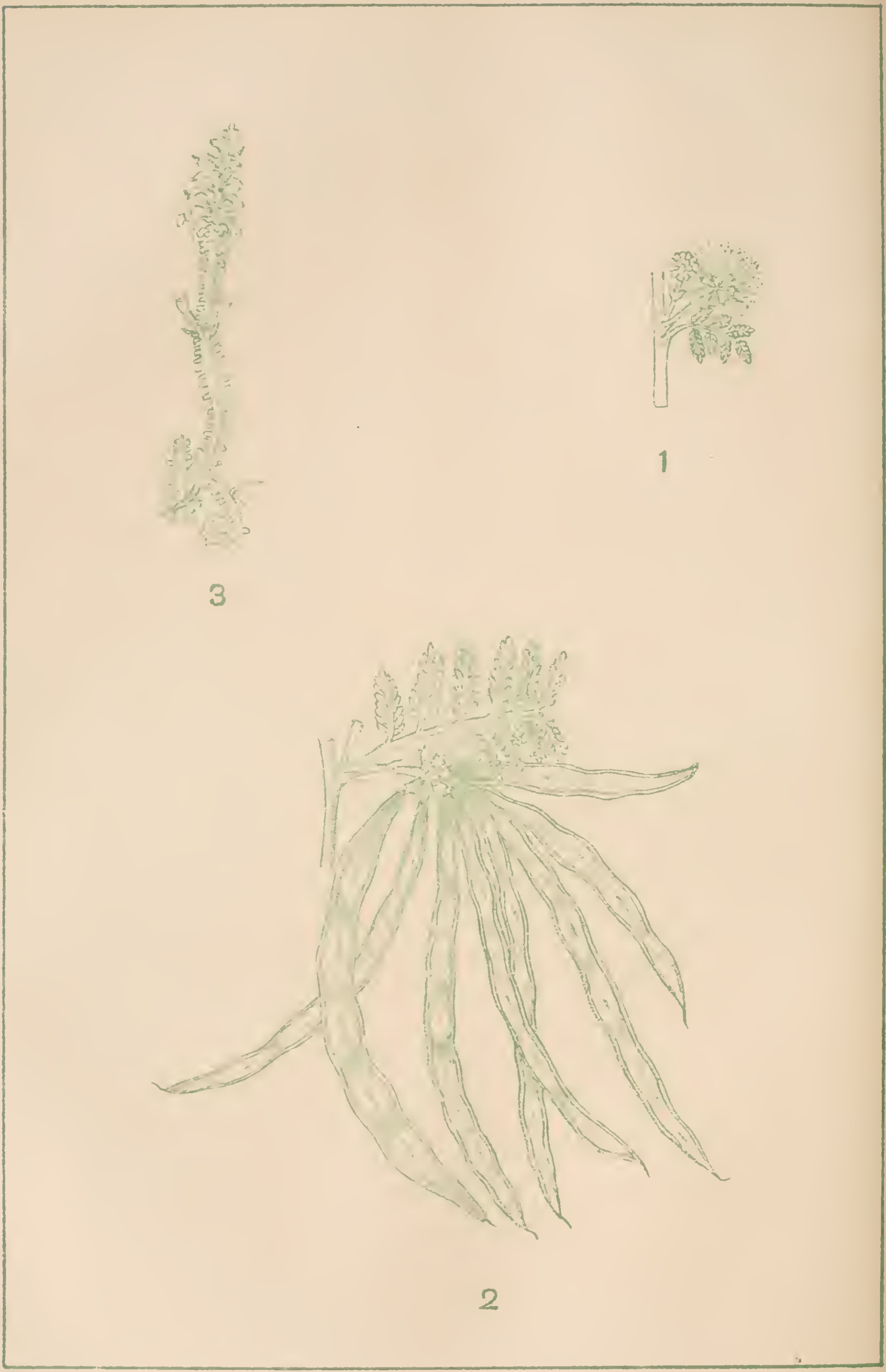
Teratological Effects.

The fungoid growth produces considerable general hypertrophy and some distortion of the parts involved; it causes at the same time the occurrence of certain abnormalities of structure.

The species affected, *Acacia eburnea* of Willdenow, is characterised by having its florets arranged in globose heads. These heads are borne on slender stalks that arise from the axils of developed leaves; the stalks are near their middle surrounded by a ring of small bracts. The free ends of the stalks are slightly thickened and it is to this slightly thickened sub-globose facetted part of the stalk that the florets are attached. The individual florets do not possess special stalklets. So much of the structure of the normal inflorescence it is necessary to detail in order to make the conditions in the diseased flowers intelligible.

In the diseased flowers a ring of florets makes its appearance in the axils of the bracts near the middle of the stalk that are normally sterile. The thickened end parts of the stalk that are normally short and globose become elongated in such a manner as to transform the globular flower head into a cylindric spike on which the florets instead of being crowded together are arranged at short intervals from each other. At the same time each of the florets developes a short special stalklet, and in place of all the florets opening simultaneously as they do in the normal flower-heads, those florets in the diseased spikes that are nearest to their apices are smaller in size and later of growth than those below them. It ought to be noticed that even in fruit there is no tendency in undiseased plants to elongation of the part of the stalk to which the pods are attached, and no disposition on the part of the pods to ripen more quickly at the outside of the branch than in the centre. At the same time it has to be repeated that it is entirely owing to special elongation of this part of the stalk in diseased flowers that the flower-head becomes changed from a ball into a spike, because the interval that in normal flower-stalks exists between the barren bracts and the flower-heads themselves still continues to exist, *destitute of florets,* between the circle of florets that appears abnormally in the axils of the bracts and the basal florets of the cylindric spike. This interval which in undiseased flowers is 5—6 mm. long, measures 10—12 mm. in diseased ones. But the increase in length of this part is merely due to the general hypertrophy produced by the disease, and it is not its size but its existence at all in the diseased flower that is of interest.

Expressed in technical teratological language the conditions induced by the disease are:—Increase in the size of the parts affected by *general hypertrophy,* with some alteration of shape by *distortion* combined with conversion of florets from sessile to pedicellate by *elongation,* conversion of a capitate inflorescence into a spike by *apostasis,* change of a simultaneous and therefore at least sub-definite



ACACIA EBURNEA WILLD.

inflorescence into a palpably indefinite one by *heterotaxy*, and the appearance of a new circle of florets by *prolification* of flower-ends in the axils of the median peduncular involucre.

Explanation of figures in Plate B :—

1. Flower head with opened florets and head with florets unopened in axil of the same leaf of *Acacia eburnea*, Willd.
2. Young infruitescence shewing that even in fruit there is no tendency to elongation in that part of the peduncle to which florets and subsequently pods are attached; from the same plant as preceding.
3. Diseased flower (covered with the granular papillæ indicative of the disease) shewing *distortion* of leaf; *general hypertrophy* of portion of branchlet, stipular spines and inflorescence; *prolification* of florets in the axils of the peduncular bracts; *apostasis*, and at the same time *heterotaxy*, in the normally floret-bearing portion of peduncle; with pedicellation of individual florets that are normally sessile.

NOTES ON OATES'S BIRDS OF INDIA.

THE appearance of Mr. Oates's volume on the birds which forms part of the "Fauna of British India," edited by Mr. W. T. Blanford, and published under the auspices of the Indian Government, is an event of great importance to ornithologists, and for the benefit of our Indian readers we have strung together a few notes which may be of service to the numerous students of bird-life in India. Mr. Eugene Oates is a Civil Engineer who has seen long service in the East, one of those officers whose work it has been to open up British Burma to the influences of civilisation. Like many other intelligent officials, Mr. Oates has found time during the intervals of road and canal-making, bridge-building, &c., to study ornithology, and he was one of that famous band of contributors who rallied round Mr. Hume and his ornithological journal—"*Stray Feathers*." When on furlough in England in 1881—1883, he wrote his "Hand-book to the Birds of British Burma—" a book which at once placed Mr. Oates in the front rank of British naturalists. That he is possessed of the true spirit of self-sacrifice in the cause of science has been shown by his willingness to come to England on half pay, in order to write the ornithological portion of the "Fauna of British India." We hope that ample leave of absence will be granted to him to finish with his own hands the task which he has commenced with so much credit. Mr. Oates has undoubtedly been much hampered by the mode of publication which the "Fauna of British India" has taken, for the compressed form in which the work is issued gives the author no scope for detail, and the ornithological volumes will be but the stepping-stones to a more elaborate work on the Avi-fauna of India, which, it is to be hoped, Mr. Oates will have time to publish. When we think of what a real faunistic work is, much, for instance, as Godman's and Salvin's "Biologia Centrali Americana," or Grandidier's "Histoire Naturelle de Madagascar," it seems a pity that the more modest title of "Hand-book" was not retained for the series of volumes on the Natural History of British India, over which Mr. W. T. Blanford presides. Granting, however, the restricted space which was at Mr. Oates's disposal, his work of condensation could not have been more ably performed, and he stands as a master of the art along with Mr. Salvin, Professor Newton, and Mr. Howard Saunders, who are the greatest ornithological experts in the compression of facts.

With the publication of the present volume will probably commence the fourth era in the history of Indian ornithology. The first we should call the "Blythian Era" (1846—1860). To the previous labours of Jerdon (1840—1844) came the supplementary labours of Blyth, whose residence in Calcutta was marked by that wonderful series of papers on Indian Biology, which gathered up the threads of information from all corners of the British Asian Empire, but which were never published by the author in a connected form. Then came the "Jerdonian Era," from 1860—1872, when Jerdon reduced to order all the scattered details of Indian ornithology, and paved the way with his "Birds of India" for the "Humian Era" (1870—1882). Around the name of Mr. A. O. Hume will cluster for ever the memories of some of the best ornithologists which England has ever produced, and the work which was done under his leadership was truly remarkable. The collection which he personally made, the enthusiasm which he created in his followers, the generalship with which he directed the studies of his coadjutors, added to the untiring energy which he himself infused into every detail of his ornithological scheme, have all combined to render the "Humian Era" remarkable for its accomplishments in the history of ornithology. The purloining of his MSS. by a rascally servant, involving the annihilation of the results of years of patient labour, proved such a great disappointment for Mr. Hume, that he gave his collection, one of the wonders of the scientific world, to the British Museum; and it is on this collection that the labours of Mr. Oates have mainly been based. The Tweeddale collection of birds, and the unequalled library of ornithological works, presented by Major Wardlaw Ramsay to the British nation, have, added to the Hume collection, constituted all the material that was necessary for an author in the production of his book; and the facilities rendered by the authorities of the Natural History Museum have enabled Mr. Oates to write his work with such completeness that it will undoubtedly be considered as one of the most important of contributions to ornithology of the present day, and with the year 1890 we may look forward to the commencement of the "Oatesian Era."

We hope that ornithologists will make, if necessary, such a strong representation to the Government of India, that there may be no question about the grant of special leave to Mr. Oates to enable him to finish his work, for fear that the conclusion of it should fall into less capable hands.

Now for the work itself. The first volume consists of the "Preface," by the editor (pp. 1—10), followed by a diagram of the contour of a bird, which will be useful to beginners in assisting them to describe a specimen. There are one or two slips, which may as well be pointed out in this description for correction in a susbsequent edition. The "nape" is by no means *the same as* the "occiput;" witness such names as Parus *nuchalis* (p. 49) and Ixulus *occipitalis* (p. 217). The space allowed for the "abdomen" is too large, seeing that the "breast" is generally supposed to be the portion of the body overlying the sternum, and the "fore-neck" and "chest" are entirely omitted in Mr. Oates's vocabulary, his "breast" being occupied by what we ourselves call the "lower throat," "fore-neck," and "chest." Similarly, the portion which he calls the "back" we should divide into the "mantle," or "interscapulary region," "upper" and "lower" back. Mr. Oates fully recognises these divisions in his descriptions (Cf. *Dendrocitta frontalis*, p. 33, &c.) We also regret to see that he once more introduces the term "tertiaries" instead of "innermost secondaries." The former term implies that these quills spring from a separate bone of the wing.

In his primary classification, Mr. Oates has adopted the main divisions recently proposed by Mr. Seebohm from a revision which the latter gentleman has been making of the general characters of the class *Aves*. For the last two years Mr. Seebohm has been revising and collating all the work of recent ornithologists, and has by the most careful study, discovered many new points which bear on the classification of birds; so that of all the schemes for the arrangement of the higher orders of birds, this new one of Mr. Seebohm's seems to us to be most worthy of general acceptance. Mr. Oates briefly explains the leading characters of the Passeres (with which alone this volume deals), and illustrates the leading features of the order with a capital selection of wood-cuts, the skull of the Raven being figured to show the Ægithognathous palate. This figure is far more characteristic than the one which illustrates Professor Huxley's determination of the Ægithognathous palate in the "Proceedings" for 1867. Then on pp. 8, 9, Mr. Oates gives a "Scheme"—*i.e.*, a "Key"—for the determination of the Families of Passerine Birds, with which we could at first find no fault, as it was evidently an artificial or student's "Key," until we turned over the pages of the book and found that the author had conscientiously followed the minor details of the "Key," and had adopted the order into which the families had dropped under the artificial arrangement which he had elaborated for their identification. The result of these characterisations is that the Titmice disappear as a family, *Paridæ* altogether, being absorbed in the *Corvidæ*; the *Timeliidæ*, the "waste-paper basket" (test Tristram) of ornithologist, likewise vanish, and are replaced by the *Crateropodidæ*, which is, as a friend of ours would say, the same monkey on another bough; the *Dicuridæ* appear as a family between the *Sittidæ* and the *Certhiinæ*; the *Regulidæ* are a full-blown family, and lead from the *Sylviidæ* to the *Laniidæ* and *Oriolidæ*, which in turn approach the *Sturnidæ* by means of a new family, the *Eulabetidæ*. This arrangement of the families is a blemish on the book, and the use of an editor should have here been apparent, if he had suggested to the author that this arrangement was certain to be accepted *literally*, and that a footnote of explanation that the " Key" was an artificial, and not a natural one, would have saved the necessity of the above remarks. We know from our own experience that in the making of " Keys," where the species or genera are numerous, it is often impossible to fit them all in what seems a natural order, and certain " keys" must of necessity be more or less artificial. In such cases we have always stated that fact, and in the arrangement of the genera or species have followed what we conceived to be the more natural arrangement Cf. also Counes's Key to North American Birds (p. 230).

The chief character for the division of the ten-primaried Passeres on which Mr. Oates relies is to be met with in the plumage of the young birds. Mr. Seebohm was the first ornithologist to recognise this as a fundamental character, and it enabled him to characterise his Thrushes and Warblers in a philosophical and satisfactory manner. Mr. Oates is the first ornithologist who has carried it out for the bulk of the Passeres, and he finds that five types of nestling plumages exist in these birds.

In the *first* the nestling resembles the adult female.

In the *second* the nestling resembles the adult female, but is more brightly coloured, and generally suffused with yellow.

In the *third* the nestling is barred.

In the *fourth* it is streaked.

In the *fifth* it is mottled or squamated.

That much of the natural affinity of birds may be elucidated by the colouring of the young we do not deny, and we look upon the nestling plumage as an indication of the ancestral colouring of the species, but whether it is capable of being reckoned as a primary character for the sub-division of the Passeres we very much doubt.

We would not have the reader suppose that the characters given by Mr. Oates in his " scheme" of Passeres are the only ones on which he relies for the characterisations of these birds. On the contrary, each family is introduced with a carefully detailed account of its characteristics and full explanations are given. We will give a short sketch of the volume with its principal features. The corvidæ have three sub-families—*Corvinæ*, or Crows; *Parinæ*, Titmice; and *Paradoxornithinæ*, or Crow-tits. Mr. Oates says that the affinities of the Tits with the Crows " are recognised by all writers on ornithology." The present writer at least begs to dissent from this arrangement, for he can find little in common with such a bird as the moss-nest building long-tailed Titmouse and any species of ambulatorial, carnivorous Crow. According to Mr. Oates the Titmice must be divorced, *toto cœlo*, from the Shrikes, but then how about such forms as *Falconculus*. The difficulty of finding appropriate English names for exotic birds is well known to us, but Mr. Oates can improve on his trivial nomenclature in his second edition, *e.g.*, *Lophophanes* means "crested" Titmouse; but we find that *L. œmodius* is a "cole" tit and *L. rufinuchalis* is a "black" tit. Mr. Oates's great family *Crateropodidæ*, is virtually the family *Timeliidæ* of our "Catalogue of Birds," and we greatly prefer the latter name, for the typical genus *Crateropus* is an African form, feebly represented in Asia, and its adoption leaves a wrong impression. Six sub-families make up the *Crateropodidæ*, and the characters for their separation are most ingeniously contrasted. In the next edition we would advise Mr. Oates to bring them to the rank of "families," and the arrangement will be at once simplified. The first sub-family of the *Crateropodidæ* are the *Crateropodinæ*, or Laughing Thrushes; and here we notice that Mr. Oates has changed the position of some of the species from that in which we placed them in the "Catalogue of Birds;" but in all such instances we expect to find that he is right, for he has examined the characters of all the species with more detailed application than we were able to give in the "Catalogue." The *Crateropodinæ* are a natural sub-family, and we do not find much fault with his *Timeliinæ*. *Myiophoneus* seems to us to be too meruline to be placed so far from the true Thrushes; but Mr. Oates makes out a good case for this and his other *Brachypteryginæ*. The *Sibiinæ* are not nearly so natural a division, in our opinion, and may possibly have to be annihilated, *Lioptila* and its allies going with the *Garrulaces*, and *Staphidia*, *Iora*, &c., following *Stachyris*, or becoming merged in the *Liotrichinæ*. *Zosterops* is surely out of place among the *Crateropodidæ*, and we still retain our conviction that its affinities are Meliphagine as may be seen from the description of its tongue (p. 213). Among the *Liotrichinæ* (p. 220) are some incongruous genera, such as *Pteruthius*, *Ægithinæ*, *Chloropsis*, *Irena*, *Leptopœcile*, *Psaroglossa*, and *Hypocolius*. If *Hemipus*, *Pericrocotus*, &c., are Laniine (pp. 456, 457), we see no reason why *Pteruthius* and *Hypocolius* should not have been included.

The Bulbuls or *Brachypodinæ* are a satisfactory and natural sub-family, and we suspect that Mr. Oates's allocation of some of the species is more correct than that of our sixth volume of the "Catalogue." We notice, however, that he is inclined to reject Hodgsonian names, when they happen to have no description; but hitherto the titles published by Hodgson in Gray's "Zoological Miscellany," founded avowedly on his unpublished drawings in the British Museum, have been allowed to stand, and it is a pity that this antagonism to the names which we had established in the "Catalogue of Birds" should have arisen, e.g., *Pellorneum mandellii* (Blanf.) for *P. Nipalense* (Hodgs.,) p. 140, *Pycnonotus bengalensis* (Blyth) for *P. pygæus*. (Hodgs,). p. 271. Although we shall adopt most of Mr. Oates's amendments, we do not feel bound to follow him in this rigid adherence to nomenclatural law. Of course, he will be bound in strict consistency to reject Boddaerts' names, and here again we should not follow him.

Likewise we hope that he has some stronger reason than the fact that *Otocompsa emeria* is by Linnæus "distinctly stated have come from Bengal," for his upsetting of the nomenclature of *O. emeria* and *O. jocosa*. The locality "Bengal" had a wide significance with writers of a hundred years ago.

The author's review of the *Dicruridæ* is very satisfactory (pp. 310, 311), but the family is strangely out of place between the *Sittidæ* and *Certhiidæ*. In his family *Sylviidæ*, Mr. Oates unites all the Grass-warblers (*Cisticolæ*), with the true Warblers, and the whole of this portion of the work is very scientifically treated, though again we do not like the order of the genera. *Lusciniola* with its one species, *L. melanopogon*, is placed between the Tailor-birds or (*Orthotomus*) and the Fantail-warblers (*Cisticolæ*,) and *Acanthoptila* finds a new home near *Schœnicola* and *Chætornis*. This is apparently a good discovery of Mr. Oates, as is undoubtedly the separation of *Abrornis* from *Cryptolopha*, by reason of the hitherto unsuspected difference in the number of the tail-feathers. *Acanthopneuste* is separated from *Phylloscopus*, and to the latter are restored many of the species incongruously placed in *Lusciniola* by Mr. Seebohm in the fifth volume of the "Catalogue of Birds." Although we have hitherto associated the Cuckoo-shrikes with the Flycatchers, we do not object to follow Mr. Oates in placing them among the Shrikes, and *Hemipus* and *Tephrodornis* may also go into the *Laniidæ*. The family *Prionopidæ*, which in the third volume of the "Catalogue" we adopted from Sundervall, was never one which we felt much enthusiasm about, and it was somewhat of a "waste-paper basket," but Mr. Oates is the first ornithologist who has attempted to allocate the Prinopine genera in other families in anything like a satisfactory way.

Although we are compelled to differ from Mr. Oates on certain questions, these are really of very minor importance, and in no wise detract from our admiration of the way in which he has performed his task. It is mainly because the work is so good that we have analysed it so minutely, in order to discuss the points of difference between Mr. Oates and ourselves; and we give below a list of the modifications which he has introduced into the first volume of the "Birds of India," in the hope that they may be of service to ornithologists. We may add that the whole volume is profusely illustrated with wood-cuts, which are excellent examples of Mr. Peter Smith's work, and they are a great assistance in deciphering the minor points of structure which Mr. Oates has discovered in his classification of the Passeres.

FAM. CORVIDÆ.

SUB-FAMILY CORVINÆ.

Corvus corax.—Difference between Ravens from Sikkim and from the Punjab. Neck-hackles figured. E. W. Oates, Faun. Brit. Ind. Birds, p. 14.

Corvus sharpii, sp. n., is the Siberian form of Hooded-Crow which winters in N.-W. India: id., t.c., p. 20.

Corvus collaris, the Jackdaw of Cashmere, not distinct from *C. monedula*: id., t.c., p. 22.

Urocissa magnirostris (Blyth).—*U. occipitallis* (Blyth), and *U. cucullata* (Gould) = *U. flavirostris* (Blyth). id., t.c., p. 27.

Dendrocitta assimilis (Hume) = *D. himalayensis* (Blyth), id., t. c., p. 32.

Sub-fam. Parinæ.

Lophophanes humii (Brooks) = *L. æmodius* : id., t. c., p. 58.

Sub-fam. Paradoxornithinæ.

Scæorhynchus, gen. n. Type, *S. ruficeps* (Blyth): id., t. c., p. 68.

Paradoxornis gularis (Horsf.) is a second species of *Scæorhynchus*: id., t. c., p. 69.

Cleuasicus—Suthora: id., t. c., pp. 66, 67.

FAM. CRATERPODIDÆ.

Sub-fam. Crateropodinæ.

Garrulax galbanus (G. A.) is a *Dryonastes*: id., t. c., p. 76.

Dryonastes strepitans (Blyth) is a *Garrulax*: id., t. c., p. 83.

Trochalopterum cineraceum (G. A.), T. *rufogulare* (Gould), and *T. austeni* (Jerd.) are all referable to *Ianthocincla*: id., t. c., pp. 85-87.

Trochalopterum ruficapillum (Blyth) is the true *T. chrysopterum* (Gould), from the Khasi Hills, and *T. chrysopterum*, auct. (nec. Gould) is renamed *T. nigrimentum* (Oates, ex Hodgson MSS.) : id., t.c., pp. 90, 91.

Trochalopterum simile reinstated as a distinct species from *T. variegatum*: id. t.c., p. 96.

Grammatoptila austeni, sp. n. Daphla and E. Naga Hills : id., t.c., p. 104.

Argya hyperythra (Sharpe) = A subrufa (Jerd.) : id., t.c., p. 109.

Pyctorhis longirostris (Moore) is an *Argya* : id., t.c., p. 109.

Layardia rufescens (Blyth) and *Garrulax cinereifrons* (Blyth) must be placed in *Crateropus* : id., t.c, p. 114.

Pomatorhinus pinwilli (Sharpe) = *P. schisticeps*: id., t.c., p. 116. *P. obscurus* (Hume), distinct from *P. Horsfieldii*, id., t.c., p. 120. *P. imberbis* (Salvad.) is the form of *P. erythrogenys* from Karen-Nee and Tenasserim : id., t. c., p. 125, note. *P. inglisi* (Hume) = *P. hypoleucus*, juv. : id., t.c., p. 126.

Sub-fam. Timeliinse.

Pellorneum mandellii, nom. emend. pro. *P. nipalense* (Hodgson) (*nom nudum*): id., t.c., p. 140.

P. *intermedium* (Sharpe) = *P. minus* (Hume). Types compared : id., t.c., p. 141.

Scotocichla (Sharpe) = *Pellorneum* : id., t.c., p. 143.

Drymocataphus ignotus (Hume), apud Sharpe, is a true *Pellorneum*: id., t. c., p. 144.

Turdinus magnirostris (Moore), apud Sharpe is a *Mallacopterum*: id., t.c., p. 151.

Thingorhina, gen. n. Type *Turdinus guttatus* : (Blyth), id., t.c., p. 155.

Actinodura oglii, g. a., is a *Thingorhina*; id., t.c., p. 156.

Rhopocichla, gen. n. Type *R. artriceps* (Jerd.) with *R. nigrifrus* (Blyth) and *R. bourdilloni* (Hume): id., t.c., pp. 159—161.

Stachyridopsis lays spotted eggs, and *Stachyris* lays white eggs. *S. nigriceps*, (Blyth), *S. chrysæa* (Blyth), and *S. assimilis* (Wald.) belong to *Stachyris* and *S. ruficeps* (Blyth), *S. rufifrons* (Hume), *S. pyrrhops* (Blyth) belong to *Stachyridopsis*: id., t.c., pp. 162—166.

Schæniparus distinct from *Minla* which is placed in the *Liotrichinæ*. It contains three species: *S. dubius* (Hume), *S. mandellii* (G. A.), and *S. rufigularis* (Mand.): id., t.c., pp. 168—171.

Sittiparus, gen. n. Type *S. cinereus* (Blyth) and *S. castaneiceps* (Hodgs.): id., t.c., pp. 171, 172.

Lioparus, gen. n. Type *L. chryæsus* (Hodgs.): id., t.c., p. 174.

SUB-FAMILY BRACHYPTERYGINÆ.

Callene albiventris (Blanf.) and *C. rufiventris* (Jerd.) must be placed in *Brachypteryx*: id., t.c., p. 185.

Brachypteryx hyperythrus (Jerd. and Bl.), *B. crissalis* (Blyth) and *B. nipalensis* (Moore), must be placed in *Drymochares*: id., pp. 187—189.

SUB-FAM. SIBIINÆ.

Malacias=*Lioptila*: id., t.c., p. 196. The species are *L. capistrata* (Vig.), *L. gracilis* (McClell.), L. *melanoleuca* (Tick.), *L. castanoptera* (Salvad.), *L. annecteus* (Blyth), *L. davisoni* (Hume), and *L. pulchella* (G. A.)

L. divisoni (Hume) is not the same as *L. saturata* (Wald).), which=*L. annecteus* (Blyth): id., t. c., pp. 199—200.

Ixops (Hodgson), distinct from *Actinodura* , id., t. c., p. 203.

Actinodura daplaensis and *A. waldeni* belong to Ixops.: id. t. c., p. 204.

SUB-FAM. LIOTRICHINÆ.

Melanochlora sultanea not a Titmouse: id., t. c, p 241.

Hilarocichla, gen. n. Type, *Pteruthius rufiventer* (Blyth): id., t. c., p. 243.

Leptopæcile not a Titmouse or a Warbler: id., t. c., p. 246.

SUB-FAM. BRACHYPODINÆ.

Criniger burmanicus, sp. n.: id., t. c., p. 286.

Alophoixus, gen. n. Type, *Txus phæocephalus* (Horsf.): id., t. c., p. 259.

Hypsipetes macclellandi (Horsf.) and *H. tickelli* (Blyth) belong to *Hemixus*: id., t. c., p. 265.

Molpastes (Hume), reinstated as a genus, id., t. c., p. 267.

M. pygæus (auct. ex Hodgs.)—M. bengalensis (Blyth): id., t. c., p. 271.

Otocompsa leucotis (Gould) is a Molpastes: id., t. c., p. 273.

Molpastes humii sp. n., id., t. c., p. 274.

Xanthixus, gen. n., Type, *X. flavescens* (Blyth): id., t. c., p. 275.

Otocompsa jocosa (L.), apud Sharpe = *O. emeria* (L.), and *O. emeria* (L.), apud Sharpe = *O. fuscicaudata* (Gould) : id., t. c., p. 277.

Hemixus malaccensis (Blyth), apud Sharpe; *Xenocichla icterica* (Strickl.), apud Sharpe : and *Hypsipetes virescens* (Blyth), apud Sharpe, are all referable to *Iole* : id., t. c., pp. 283—285.

Rubigula = *Pycnonotus* : id., t. c., p. 286.

Pycnonotus pusillus (Salvad.). restored as the name for *P. salvadorii* (Sharpe): id., t. c., p. 293.

FAM. DICRURIDÆ.

Buchanga, not distinct from *Dicrurus*, id., t. c., p. 310.

Dicrurus nigrescens, sp. n., Tenasserim, id., t. c., p. 315.

Dissemurulus, gen. n., Type, D. *lophorhinus*, id., t. c., p. 322.

FAM. TROGLODYTIDÆ.

Elachura, gen. n. Type, *Troglodytes punctatus* (Blyth, nec. Brehm), T. *formosus* (Wald.) : id., t. c., p. 339.

FAM. SYLVIIDÆ.

Cisticola erythrocephala (Blyth), *C. tytleri* (Jerd.), and C. *volitans* (Swinh.) are distinct and not identical with *C. exilis*, V. and H. : id., t. c., pp. 371—373.

C. granilis (Frankl.), *C. rufescens* (Blyth), and *C. cinereicapilla* (Moore) belong to *Franklinia* : id., t. c., pp. 376—379.

Acanthopneuste, distinct from *Phylloscopus* : id., t. c., p. 411.

A. davisoni, sp. n. : id., t. c., p. 420.

Abromis has ten tail feathers, and is distinct from *Cryptolopha*, which has twelve : id., t. c., p. 428.

Cryptolopha tephrocephala (Anderson) distinct from *C. affinis* : id., t. c., p. 423.

FAM. LANIIDÆ.

Pericrocotus elegans (McClell.) (type examined) is *P. speciosus* (Lath.), so that *P. elegans* (Sharpe et auct. dec. McClell.) must stand as *P. fraterculus* (Swinhoe) : id., t. c., p. 479.

Lalage = *Campophaga* : id., t. c., p. 491.

FAM. STURNIDÆ.

Sturnius humii vice *S. indicus* (Hodg.) (*nomen nudum*) : id., t. c., p. 520.

Agropsar, gen. n. Type, *Sturnia sturina* (Pall.) : id., t. c., p. 530.

Sturnia burmanica (Jerd.) and *Acridotheres leucocephalus* (Gigl. and Salvad.) referred to *Graculipica* : id., t. c., p. 536.

R. BOWDLER SHARPE.

(*The Field, March* 15, 1890.)

SOME NEW BOOKS OF INDIAN ZOOLOGY.*

In the early years of Her present Majesty's reign, the few naturalists of India worked almost "on their own hook"; at any rate, with little assistance. A handful of Madras doctors and one Madras Civilian, a Bombay doctor or two, and scarce any one else in Bombay. A little group centreing at the Bengal Asiatic Society, with Blyth and Hodgson as leaders, were preparing the way. Except Blyth himself, and the early martyr Helfer, scarcely one was what we now call a professional naturalist, devoted to India, though some birds of passage of that feather had come and gone.

Meanwhile the flood of the Victorian age was setting in strong at home. The late Prince Consort, after his fashion, was aiding and encouraging every science and art ; and new names were already beginning to be known in scientific circles that have since become known to the world.

The outer circles of the wave were felt even in the somewhat Philistine Secretariat of India, and Lord Canning's Government, casting around for a competent man, directed Surgeon-Major T. C. Jerdon, of the Madras Army, to compile a set of manuals of the mammals, birds, fishes, and reptiles of India.

No better man could have been found in the Services. Probably the only other possible man was the lamented Blyth, Jerdon's friend, and perhaps his superior as a naturalist, but probably not his equal for the matter in hand. At any rate, the acknowldgment of Jerdon himself, couched in most generous terms, leaves little room for doubt that all that could be done for the work by Blyth was done by him.

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* "THE FAUNA OF BRITISH INDIA, INCLUDING CEYLON AND BURMA." Published under the authority of the Secretary of State for India in Council. Edited by W. T. BLANFORD, F.R.S. London: Taylor and Francis. Calcutta: Thacker and Spink. Bombay: Thacker & Co.

"MAMMALIA," Vol. I., PART I., by W. T. BLANFORD, &c. "FISHES." 2 Vols. (complete), by FRANCIS DAY, C.I.E., LL.D., Deputy Surgeon-General. "BIRDS," Vol. I., EUGENE W. OATES.

"THE AVIFAUNA OF BRITISH INDIA AND ITS DEPENDENCIES." By JAMES A. MURRAY, Member of the Bombay N. H. Society, &c. London: Trübner & Co. Bombay: Education Society's Press.

The dates of Lord Canning's orders on the subject are not available to the public, but probably they were issued in the early days of his Viceroyalty, and the starting of the work was delayed by the outburst of the Mutiny. Jerdon served in it with his corps, and was one of those whose courage and endurance left India to future naturalists. In 1862 he dedicated the first part of the "Birds of India" to Lord Elgin, and the latter was scarcely cold in his grave, when the volume on "Mammals" was published. The writer evidently hoped to live to publish those on Reptiles and Fishes, but the hope was not fulfilled. It may be that some day some one may publish a memoir of his career. There is a certain note of kindliness and modesty in his writings, which leads the reader to think that he must have been a most charming comrade as much at the mess table as in the jungles he explored so well. Both the "Birds" and the "Mammals," too, are books of high literary merit in their way: pure English expression, untainted by slang, pedantry, or jealousy.

Jerdon's work was resumed when the Ray Society published Dr. Günther's fine monograph on the "Reptiles of India," and was completed when his friend Dr. Day completed *his* great work on the "Fishes of India." Both of these were works on a far grander scale than had been allowed to Jerdon. The former was soon followed by Dr. Nicholson's (another Madras doctor) "Indian Snakes," and the latter was published almost simultaneously with the then Lieutenant Beavan's "Freshwater Fishes of India."

Mr. Murray was already at work in Sind and Mr. Oates in Burma before Dr. Day's *magnum opus* was published. Mr. Hume was editing *Stray Feathers*, and the Indian naturalist had a chance of a library at last, for the study of the vertebrata.

But the years of the Crimean and Persian wars, the Mutiny and those that followed them, were not years suitable for the extension of science amongst amateurs. The best men of the Services were fully occupied in the giving and taking of hard knocks, and, when that was over, in picking up the pieces.

The great American war turned many vigorous minds exclusively to cotton and stock-jobbing, and the lamp that burned from 54 to 64 got but little new oil in that decade.

The doctors and the Geological Survey men were they who chiefly kept it alight when Blyth and Jerdon were gone. The culture of the early competition-wallahs was chiefly literary, and that of their military contemporaries was, when not literary, mostly mathematical or artistic. Nothing could better show the state of things than the fact that Jerdon's volume on Mammals was only *reprinted* (not edited) in 1874, the "Birds," I believe, not until 1880 or thereabouts.

The latter was so scarce a book that each of three volumes that I possess is to me the relic of a separate friend that got it for me—one dead, one gone, and one serving afar off.

But the ebb was over, and the flood had set in again; those who were really capable of becoming centres of inquiry were every day finding more and more who would contribute chance facts or specimens. The *Bombay Gazetteer* office was routing out everybody who knew anything about anything, and lent a great impulse to every kind of inquiry by its studious and honourable acknowledgment of every contribution of fact.

The *Indian Antiquary* was waking up other branches of investigation as long ago as 1872, and it could not do so without the echo reaching Natural History.

For, as any one familiar with Anglo-Indian culture cannot help remarking, in every science the leading men must necessarily be those who devote themselves chiefly to it; but the second rank, the observers and collectors of specimens, are generally men of somewhat varied tastes.

Life in the Mofussil is generally deadly dull. Shikar is not everywhere. A chance of making love is a rare luxury and the "flowing bowl" apt to be a snare.

Music, except for the favoured few who can play the fiddle, is not portable. (I decline to count the banjo.) So the man who has the best chance of a tolerable existence is he who can get enjoyment equally out of a bird, a fish, a rat, a stone in its natural state, or the same in that of some crumbling temple, a scrubby bush (any fool can appreciate a big tree), or, in short, *Omnis res scibilis*. This sort of versatility does not make scientific masters, but it does make men who can bear a hand, and some men possessed of it have been very valuable to more than one science. I need only quote such names as those of Brian Hodgson, Sir Walter Elliot, and that 19th century Elizabethan, the late Colonel Yule.

On men of this sort of culture the last few years have acted with great force, and this is the state of things that has, for instance, filled half a big house with the Anthropological and our own Society, neither of them in receipt of any extraneous aid, nor impelled by any power but the free will of their members.

A society in this condition has naturally been clamorous for books of reference, and a good deal of public money has been spent in answering the demand. It is the fashion to say that Government is stingy, but the truth is that Government has done a good deal in this way. No province of any nation need be ashamed of the Bombay Archæological Survey and its splendid quartos, nor of the *Bombay Gazetteer*, a new edition of which is already under discussion.

A somewhat meagre Geological manual and a very good Meteorological one have been issued within the decade, and what we wanted most was a set of tolerably cheap zoological manuals for all India.

The Secretary of State has undertaken the supply, and entrusted Mr. W. Blanford, late of the Geological Survey of India, with the superintendence of it. It is not likely that he could have chosen a better man for his work.

An early scientific training, natural aptitude, and twenty years of the East, are qualifications that may well bespeak confidence and respect for the Editor of the *Fauna of British India*; and if, in examining his work, we find reason to complain of parts of it, he may well ask us if we could have done better.

It is, however, the duty of a critic to speak his mind without fear or favour, and so we hope to do in reviewing the works noted at the head of this article.

Dr. Day's two volumes on "Fishes" are the only part of the "Fauna" yet complete, and possess a melancholy interest as the last work on earth of their author. He held on, under considerable difficulties, until he had already been warned to "make his soul" for the approaching end, and the present writer thinks that it wanted little making. It is merely a cheap and portable abridgment of his great work, with a few additions to bring it up to date, and the fine engraving left out for economy's sake. It is, however, worth noting that in this last work Dr. Day has finally abandoned the old classification in which the sharks, saw-fishes, and skates were taken as the lowest fishes, and has put them at the top of his list.

The ichthyology of India gave no opportunity for discussing the claims of *Lepidosiren* and *Ceratodus* to this position, because we have not yet found either here. And, as Dr. Day wrote within narrow limits of space, and the Editor admits having squeezed his literary bones in their *coffin*, we shall not soon know his opinion on this point.

It had been an act of grace in Mr. Blanford, in such a case, to have refrained from what he calls "additional compression." There are some of us would rather he had put the screw on the Mammals. He has no excuse for referring us for the "limits of the area" to the half volume of Mammals already published. For he had three-quarters of a page to give them in, which is now blank; and many people will buy a whole book of fishes who will not *buy* a quarter book of mammals.

The references to "Mr. F. Day, C. I. E., Deputy Surgeon-General," are in a rather stupid style of official pedantry. "Dr. Day" died "Dr. Day" not merely by courteous custom, but by the law of his country, and so he was rightly addressed and quoted, in speech and in black and white. *Requiescat in pace.* It will be long till the Fishes of India look upon his like again;—*and vice-versâ.*

The man who has these two volumes, Lieut. Beavan's "Fresh Water Fishes of India" and Mr. Thomas's "Rod in India"—has the Indian fisherman's library. If he wants more, he can look out for the second (Dr. Day's own) edition of his great work, and these four books, judiciously interleaved and annotated, will last him his lifetime.

These two volumes on Fishes have been first noticed of the "Fauna," because they are the only complete part of it yet issued.

The Editor himself opened the ball with a paper bound "half volume" on the Mammals. This is nearly two years old now, and as yet there is no sign of the second half volume. We wish people would call volumes volumes, and not "half volumes."

The instalment, however, has conspicuous merits. To begin with it is the only book of the lot, as yet, that has its price plainly marked on it; secondly, it is the only one which has not been subjected to what the Editor euphemistically calls "compression." We should prefer to call it *desiccation.* In a case of this sort, it is better to be the compressor than the compressed. At any rate, we have here a complete list of the Mammals of India, so far as the half volume and the author go, and probably no man alive could have done it better.

The style, compared to that of the early Victorians, is undignified and meagre, but it is *alive* in its way, and we know now what a most competent authority—probably *the* most competent—thinks about so many of our beasts as he has yet found time to give us his mind about. The book is really a book, and not a catalogue of flat skins; and the sooner we have the rest the better. We shall then lay our old well-pencilled volumes of Jerdon's "Mammals of India" aside (with a sigh no doubt), but aside for all that.

Perhaps the point most interesting to sportsmen in this half volume is that Mr. Blanford finally disposes of the distinction between "leopard" and "panther." Many—the present writer amongst them—had long clung to the idea that these were two, but it seems impossible not to admit the force of Mr. Blanford's arguments for their identity; and our own collection of skulls bears the same way. The very puzzling Indian Otters are here for the first time reduced to intelligible order, and the mysterious "Mumh" of Beluchistan becomes a commonplace black bear, which we are to call *Ursus torquatus* instead of *Thibetanus* as hitherto, because although found on the Himalayas and even in China, it does not appear to have been recorded from Thibet.

Information about the Hedgehogs is evidently much wanted; Mr. Blanford seems a little at sea about their distribution, and is clearly unaware that they are common in the north of British Gujarat. There seem to be two species, probably *Erinaceus pictus* and *E. Jerdonia*.

One curious correction our own records enable us to make,—for Mr. Sterndale has here recorded that the White-browed Gibbon does not "drink with its lips putting its head down to the water, but dips its hand in the water and then licks the back of it." This is probably the action recorded of the White-handed Gibbon by Mr. Blanford as " scooping up water."

Few of the illustrations are original, and none of any artistic merit, but the anatomical drawings have considerable scientific value apart from these considerations.

On the whole, as observed above, if we ever get the rest of this book, it is going to be " The Mammals of India."

As regards the Reptiles and Batrachia, we are promised a volume or so from Mr. Boulenger of the British Museum, a most competent authority, except for the trifle that he is not known to have ever been in India for anything worth calling a residence. It will be time enough to criticize Mr. Boulenger's work when we see it; and he, if any man, deserves kindly criticism, for his aid has been unsparingly given to all Indian Naturalists who have sought it.

The next thing to consider is the Ornithology.

Of this we have as yet a single volume devoted to the Passerine Birds, and fathered by Mr. Eugene Oates, whose name is already favourably known to this Society. It is to be regretted that the Editor (not Mr. Oates) has thought fit to preface it with the remark that " the classification adopted by Jerdon was obsolete even when he wrote," which is in very bad taste and inaccurate.

The classification in question is hardly obsolete yet, and several observations of Jerdon's show that he adopted it, as others since him have done, for the sake of his readers. The result has justified him. His work is at this day an Indian Classic. Let us see what is offered to us to supersede it.

Any modern Indian Ornithology must contain nearly 50 per cent. more species than Jerdon's work, chiefly, as Mr. Blanford is careful to observe, because the modern area is nearly double of Jerdon's, and includes countries very different from those to which his work was restricted—*by order*. He did, so far as he could, remark upon the species of what were, to him, borderlands, and are to us as naturally parts of British India as Madras and Bombay. But Ceylon, Burma, the Malay Peninsula, and much of his Afghanistan and Beluchistan are now parts of British India.

Hence, rather than from any failure of his or his predecessor's and colleagues, arises the enormous increase in number of species now before us.

It will be remarked that in North-western India the increase is chiefly in migratory Palæarctic birds. On the Malayan side, *per contra,* it is, necessarily, in tropical forms. It is to be regretted that this work is by no means calculated to take the place of Jerdon's. Mr. Blanford's (or perhaps the Secretary of State's) compressing apparatus has been at work; and the present volume is very little more than a Museum Catalogue of dried skins. That Mr. Oates and Mr. Blanford can do better than this we know (many of us by personal intercourse), and the waste of the opportunity now offered is the more to be regretted.

The classification is no doubt very scientific; but the catalogues of the British Museum are good enough for ours, and Mr. Bowdler Sharpe, of the same, is rather "down" on our author for confusing a "key" with a "classification," and wants to know where the editor was when this was done? Mr. Sharpe, indeed, mingles blessings with his objurgations, and thinks that the present period of Indian Ornithology will be known as the "Oatesian Era," wherein Mr. Sharpe is very widely astray. The period when one man could name an era in Indian Ornithology is over.

Messrs. Blanford and Oates have indeed given us half a stone where we asked for bread. But they have not, in the language of the turf, given us "a stone and a beating." While they have been pottering over their list of the skins in the British Museum, the Bombay Education Society has brought out Mr. James Murray's Avifauna of British India.

It is first in the field to replace Jerdon's admirable, but now obsolete work. In the important matter of illustration, it is far superior to what we have, as yet, of Mr. Oates's book. Like that, it is too much of a mere catalogue; but the fault is much less in the Indian work, and, upon the whole, the present writer considers it much the fitter book of the two for district use.

It may, perhaps, be added that whereas the volumes, as yet apparent, of the Secretary of State's Fauna have been published under great patronage, the Avifauna of India has been carried through in spite of poverty and what might almost be called persecution; and its appearance in print at all is the work of this Presidency or of some people in it.

It may now, however, on merely utilitarian grounds, be recommended to such members of the Society as may want a modern Ornithology of India, and not care to wait for Messrs. Blanford and Oates's very doubtful next issue.

Kolaba, May 1890. W. F. SINCLAIR.

MISCELLANEOUS.

SECOND NOTE ON LOCUSTS IN INDIA.

In November last a short preliminary note on locusts in India was issued with a view to showing briefly what was known on the subject, and indicating the points to which attention should be directed during the locust invasion which had then commenced in North-West India. In response to this appeal a considerable amount of information has reached the Indian Museum for incorporation in the general detailed report which is in progress. The materials, however, for anything like a complete account are still very deficient, and as there seems every probability of the locust invasion continuing through another season, this second note has been written with a view of indicating what has already been ascertained, and hence of showing the points on which further information is desired.

The locusts have now spread themselves over Sind, Rajputana, the Punjab, North-West Provinces and Oudh, besides penetrating sporadically into Guzerat, Ahmedabad, Baroda, Kandesh, and parts of Central India, and appearing in the Kistna district of the Madras Presidency. They have done a considerable amount of injury to standing crops, especially in Rajputana and Sind. Specimens have been forwarded (*) to the Indian Museum, from Karachi, Marwar, Jeypore, Ajmere, Merwara Mooltan, Naini Tal, Rawalpindi, Kistna, Etawah, Muzaffargarh, Lahore, and Bahraich ; they all prove to belong to the species *Acridium peregrinum*, (†) which is said to range throughout all the dry country extending from Algeria

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(*) Through the kindness of Mr. W. D. Cumming, Surgeon-Major Hendley, Colonel G. H. Trevor, Mr. C. F. Elliot, Dr. William King, the Deputy Commissioner, Rawalpindi, the Superintendent of the Government Central Museum, Madras, the Collector of Etawah, the Director of Land Records and Agriculture, Punjab, the Superintendent, (?) School of Art, Lahore, and the Deputy Commissioner of Bahraich, respectively.

(†) To prevent the possibility of error in the determination of the species, specimens have been submitted to the two well known Entomologists, Dr. Henri de Saussure and Mr. W. F. Kirby ; these two gentlemen have most kindly examined them and agree in considering that they belong to the species *Acridium peregrinum.*

on the west to North-West India on the east(*). It has often proved most destructive in Algeria and has generally been supposed to be the *locust* of the Bible; but it must not be confounded, either with the locust which has appeared in Algeria during the past three years (1887, 1888, and 1889), and which belongs to the species *Stauronotus maroccanus*, or with the locust which invaded the Deccan in 1882-83, though the latter insect was often erroneously referred to as *Acridium peregrinum*(†).

Flights of locusts appeared in June 1889 in Sind, and by September had spread over the whole province, from Shikarpur to Karachi. In the beginning of August young locusts were observed by Surgeon-Major Hendley in Marwar, between Didwana and Sambhur; these had, no doubt, hatched from eggs laid by winged swarms about the end of June, and therefore show that winged swarms were present in Marwar about the same time that they appeared in Sind. In September flights appeared first in Mooltan and afterwards in Dehra Ismail Khan; they were also found in Ulwar, Kishengurh, Jeypore, Sirohi, and in Ahmedabad. (‡) In October, besides maintaining themselves throughout Sind, Rajputana, Mooltan, and Ahmedabad, they penetrated south into Baroda and Khandesh. In November they reached, on the South-West Guzerat, and on the North-East Banda, Jhansi, Agra, Cawnpore, Etawah, Bareilly, and Bahraich. During December they continued to spread over the North-West Provinces, reaching Rae Bareilly, Fatehgarh, and Naini Tal; they also penetrated southwards as far as the Goona Agency in Central India, besides being reported from Rajputana as before. In January 1890, flights were reported from Lahore, Muzaffargarh, Rawalpindi, Ferozepur,

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(*) Locusts passed over the British India Steam Navigation ship *Golconda* on November 25th, 1889, when off the great Hamish Islands in southern portion of the Red Sea (*Nature*). Also over the Peninsular and Oriental ship *Clyde* about the same time. They were noticed to be reddish in colour, and consequently likely to have been *Acridium peregrinum*. In 1869, also, the year of a great invasion in Rajputana of a locust which was probably *Acridium peregrinum*, locusts were noticed in great numbers in the Red Sea (Swinhoe). It would, therefore, be interesting to ascertain to what extent 1889 and 1869 were years of locust invasion in the intervening countries of Arabia, Persia, Baluchistan, &c.

(†) It is particularly necessary to distinguish carefully between the Deccan locust of 1882-83 and the Rajputana locust of 1889, as there are important differences in habits of the two species which make it that measures applicable for the destruction of the one are not always suited to the other.

(‡) Locusts were reported from Ahmedabad as early as July; it is doubtful, however, whether the first that appeared belong to the migratory swarms of *Acridium peregrinum*; no specimens have been obtained for examination, but specimens that were forwarded, as the *locust* which did injury to crops in Kathiawar in August, proved on examination to belong to a species which has been determined by Dr. Henri de Saussure as *Hieroglyphus colesiana* (de Saussure); this insect is totally distinct from *Acridium peregrinum* and is thought to be of purely local origin.

and also from the Kistna district in the Madras Presidency. Their presence was also noticed in Sind, but no mention was made of them in reports from Rajputana. In February they were again reported from different parts of the Punjab (Lahore, Rawalpindi, Dehra Ismail Khan) and also from Sind.

The above sketch of the spreading of the locusts seems to point to the sandy tracts of Western Rajputana as the centre from which they radiated. This being the tract from which it was supposed that the locusts came in 1869, when Rajputana was invaded by what appears likely to have been the same species of insect, and the fact that *Acridium peregrinum* periodically invades Algeria, from the direction of the Sahara desert, increases the probability of the supposition.

Wingless larvæ have been received from Marwar, where they were found by Surgeon-Major Hendley in the beginning of August, and also from Jodhpore and Karachi, the dates of their capture not having been recorded; a specimen, however, said to have just emerged from the wingless state was received from Karachi, where it had been found by Mr. Cumming on 2nd November. These data, incomplete as they are, point to the invading flights of locusts having reached, on the one side Sind and on the other Jodhpore and Marwar, before depositing their eggs in June and July. Soon after this latter date the parent locusts no doubt died off, according to the known habits of their species, leaving the young locusts to develop; we accordingly find a lull until about September, in which month the earliest broods appear to have become full grown, acquired wings, and commenced to spread in flights. These flights seem to have gradually travelled northwards into the Punjab, and eastwards and southwards, across the Aravalli mountains into Eastern Rajputana, Central India, the North-West Provinces, Oudh, Khandesh, and Baroda, a stray flight penetrating even as far as the Kistna district in the Madras Presidency. They have flown backwards and forwards over this vast area in swarms which have alighted at intervals to devour the crops which they generally completely destroy where they alight, though their numbers have been too small to create any widespread calamity.

With regard to the future history of the locusts, the known habits of these interesting creatures enables us to predict with considerable certainty at least the general lines on which they will proceed. The flights of winged insects, now present in many parts of India, will probably continue during the remainder of the cold weather flying about the country and alighting at intervals to devour crops. They are, however, except in such sandy tracts as those which extend from the Araval mountains on the east to Sind on the west, under unnatural conditions, and may therefore, be expected to perish in great numbers, from disease and the attack of their innumerable foes, before their time comes in the spring to deposit their eggs and die of old age, after completing the natural cycle of their existence. In their desert home they would probably not commence laying their eggs before May or June next, when their instinct told them that the time for vegetable growth was approaching; but under the damper conditions of the districts they have now invaded, there is every probability that they will commence ovipositing very much earlier than this date. It is impossible to predict the date with any degree of certainty, but March and April are likely, at least in many cases, to see a large number of eggs are deposited. After the eggs are deposited the parent locusts will soon die off and the fate of the young locusts will, to a great extent, depend on the atmospheric conditions that obtain. They will undoubtedly be less healthy than their parents, and will probably be afflicted by all manner of diseases and parasites, whose history it will be most interesting and instructive to observe. If the year is an exceptionally dry one, they may succeed in passing through their various stages in numbers sufficiently vast to do an indefinite amount of injury both in their larval, and winged stages, but under ordinary condition it is to be expected that the vast bulk of them will die off before acquiring wings though injury may be done by them, in their earlier wingless condition.

An account of the remedies applicable to these locusts was given in the first note, and subsequent enquiry has only confirmed the statement there made that the best time to attack them is in the wingless condition, in which they emerge from the eggs, and long before they have acquired wings. They are then little black, helpless creatures which band themselves together and can readily be driven like sheep—into pits, or any other kind of trap prepared to receive them. The Cyprus system of screens and pits (described in the first note), could probably be utilised with advantage, but the prospects of serious injury from the locusts are not sufficiently alarming to make it probable that it will be considered advisable to go to any very considerable expense in introducing apparatus of the kind.

Amongst the points to which the writer would now direct attention, and upon which he will be grateful for any information, are the following :—

(1) the ovipositing which is likely to take place within the next one or two months;

(2) the diseases, parasites, and other foes, to whose inroads the locusts will now be especially exposed ;

(3) any emigration of fresh flights from Western Rajputana, or Baluchistan or the Suliman range.

With regard to No. 2 very little is at present known in India. The question of disease is very intimately connected with climatic conditions, for unfavourable, and especially wet, weather undoubtedly tends to produce an unhealthy condition in the locust. In the Bombay Presidency in 1883, however, the general debility observed in the locusts would seem to point to some specific disease, and the discoveries made of late years concerning contagious diseases amongst insects, due to the growth of low vegetable organisms in their tissues, render it extremely probable that the excessive mortality amongst the locusts will be due largely to some such cause. In support of this theory, besides instancing such well known insect diseases as pebrine, and muscardine, which are often most fatal to silkworms it may be useful to notice the fungi, *Isaria destructor*, Mets., and *Isaria ophioglossoides*, Kras., which are stated by Künckel d'Herculais to have caused the total destruction of the eggs of the migratory locust *Pachytylus migratorius*, over large areas in South Russian in 1884, when the fungus was investigated and artificially cultivated by two Russian naturalists Metschnikoff and Krassilstchick. In this connection, it should be observed that great care is necessary in investigating the subject of zymotic diseases amongst insects; vegetable organisms found in the tissues of dead insects being sometimes of purely *post mortem* origin.

With regard to the parasites and insectivorous animals, which are supposed to account for much of the mortality amongst locusts in India, little has been ascertained; but the observations made on locusts in other parts of the world leave small doubt as to the nature of the numerous agencies that are at work. In the United States, according to Riley, the Rocky Mountain locust (*Caloptenus spretus*) is largely kept down by insectivorous animals and parasites, some of the most effective of which are themselves insects. Riley found that besides being devoured by vertebrate animals, such as pigs, poultry and other birds, toads, frogs, snakes, &c., and by the larger predaceous insects, such as Carabid and Cicindelid beetles, Asilid flies, some species of Scutelleridæ (soldier bugs), and Mantidæ, the eggs of the locusts, are parasitized by a Dipterous insect (*Anthomyia angustifrons*), which is estimated to destroy as much as 10 per cent. of them, by a little scarlet mite, and by an Ichneumon fly; while, after the locust emerges from the egg, it is parasitized by a mite (*Astoma gryllaria*), which attaches itself to its body and sucks its juices, and by various Tachinidæ and Ichneumonidæ, whose grubs develop in its tissues and thereby cause its death. Stoll observed that the locust (*Acridium peregrinum*) in Central America, was much infested by a parasitic *Mermis* (hair worm), which was present in six out of the ten specimens he dissected. While Künckel d'Herculais states that in Russia it has been observed that Nematode worms pierce the locust egg cases and penetrate into the eggs which they destroy. In India little has been recorded beyond the fact that in the Bombay invasion of 1882-83 kites and crows fed upon the locusts, and that the presence was observed of two species of parasites, *viz.*, "small red parasites," which were observed clinging to the bodies of the locusts, and which are likely to have been mites, allied to the *Astoma gryllaria* of America, and a "hair worm," which was reported to kill the locusts, no further particulars about it however being given, though it would seem likely to be a Nematode, allied to those observed in Russia and Central America.

E. C. COTES,
Indian Museum, Calcutta.

The 21st February 1890.

A MANUAL OF FORESTRY.*

Professor Schlich's new Manual of Forestry will probably form the standard work for the instruction of Indian Forest Officers. In the interest of science,

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* This letter appeared in the *Bombay Gazette* on the 20th March 1890.

I therefore beg leave to point out a few errors and omissions in the scientific part of the first volume, which may be of minor importance for the practical forester, but would certainly lead to a serious misconception of the physiological facts on which all culture of plants is based :—

In Part II., Chapter 1, under "Atmospheric Air," the author having stated the proportion of nitrogen and oxygen, writes :—" No chemical process is required to separate one constituent from another ; as a matter of fact, all porous bodies possess the faculty of taking oxygen from the atmosphere, without entering into a chemical combination with it. Amongst such bodies are the soil and the leaves of plants. Whether nitrogen is similarly taken up has not yet been proved, but further investigation may lead to important discoveries in this respect, as it is unlikely that the large store of nitrogen should only serve as a dilution of the oxygen.

This statement is entirely erroneous : as a matter of fact the two gases, though only forming a mechanical mixture, cannot be entirely separated, except by a chemical process, and only to a very small extent by mechanical means as by dilution in water, which is capable of dissolving proportionately more oxygen than nitrogen, or by allowing air to pass through an india-rubber membrane, in which case oxygen passes quicker than nitrogen, owing to the condensing power of india-rubber, which is greater in relation to oxygen than to nitrogen. Porous bodies take up the nitrogen as well as the oxygen, and except where a chemical process or combustion takes place and the oxygen combines with other substances, as in the case of leaves, and frequently in soil, it is only exceptional if ever oxygen is mechanically absorbed in greater proportion than nitrogen. The author proceeds to say : "Although the leaves of plants take up oxygen during the night and in the shade, they exhale greater quantities of it under the effect of light," &c. This is but partly correct, as the plants constantly, even in the fullest light, inhale oxygen, exhale carbon dioxide, and breathe just like animals, but this vital action, essential for the preservation of life, is, during the day, through the influence of light, partly obscured by the powerful decomposition of carbon dioxide. by which process carbon is assimilated and oxygen returned to the air. (Though the plants may at times show no outward sign of absorbing oxygen, there is now no longer any doubt that a sufficient amount of free oxygen is always available for combustion between the molecules of the cells, which enables the plants to live a certain time without the access of oxygen, just as it has been proved to be the case with frogs, &c.)

Under the heading "Carbon Dioxide," the author states :—" Plants take the great bulk of the carbon dioxide, which they require, through their leaves, from the atmosphere, only a comparatively small portion is taken up through the roots." The fact is that as just stated the green plants only absorb carbon from the carbon dioxide and return the oxygen. The oxygen necessary for forming carbonates is taken partly as oxygen from the air, and partly from water and mineral salt. A certain amount of carbon dioxide is taken up by the roots in water and carbonates, but is not assimilated. Parasities and fungi only take up previously assimilated carbon from their food-plants or from decaying organic matter.

Under the heading "Ammonia and Hydrogen Nitrate," the author states that it has not yet been ascertained how the necessary quantity, besides the contents of the annual rainfall, is obtained. There is, however, no doubt, that the soil always contains a sufficient quantity of ammonia-salts and nitrates to account for the nitrogenous matter found in plants, and it has been proved that with the exception of fungi (and perhaps other parasities) no plants are capable of assimilating the atmospheric nitrogen or ammonia.*

It might have been desirable in a book of this scope, to give a short outline of the movement of water in plants, the more so as this process has not been ascertained until comparatively recently after having for many years remained an unsolved and much disputed problem.

It must be regretted that a book which deals with its subject in such an admirably clear and demonstrative way, and is full of valuable information, should contain those few, but scientifically important errors.

Victoria Gardens. G. CARSTENSEN.

MR. GILES' DRAGON-FLY.

WITH reference to a note by E. Giles in No. 3, Vol. IV. of the Journal, I would point out that Mr. Giles is almost certainly wrong in calling his insect a "dragon-fly." I do not know much of the neuroptera, but such a feat as he ascribes to a "dragon-fly" could not, I think, possibly be performed by one. The scene described, however, is very much what occurs each time Chlorion (a genus of the Sphex family of Fossorial Hymenoptera) has occasion to lay an egg. The cricket is paralyzed by stinging, and then buried to serve as food for the larva of Chlorion, when it shall hatch from the egg buried with the cricket. There are two fairly common species, *C. splendidum* (Fabr.) and *C. lobatum* (Fabr.), the latter, I think, is Mr. Giles' "dragon-fly." Dahlbom describes it as "*cyaneo-viride aut veride-cyaneum splendidissimum*; St. Fargean calls it "*verte dorée.*" Smith, however, in his Brit. Mus. Catalogue writes: "An examination of a large number of specimens from various parts of India and China shows that this insect is very inconstant in colour, varying from brassy or golden green to dark blue. This satisfies Mr. Giles' description, and Chlorion has certainly a far "neater figure" than any "dragon-fly." The only difficulty is the size. Unfortunately none of the authors quoted give the size; but 1½ inches is, I should think, the average for *C. lobatum*.

Specimens of both *C. splendidum* and C. *lobatum* will be found in the Society's collection of Hymenoptera (Sphegidæ, Nos. 16 and 17).

Poona Districts, 24th March 1890. ROBT. WROUGHTON.

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* According to the latest researches, it seems certain that some Leguminous plants chiefly kinds with warted roots, assimilate nitrogen from the air, probably through the agency of Bacteria.

MEASUREMENTS OF A BOAR.

The following measurements of a boar may interest the readers of the Journal. The animal was speared (with the Nagpore Hunt) by Mr. Burlson, of the 2nd Madras Lancers, on the 1st January 1890 :—

Height	...	...	...	...	...	38″
Girth	...	...	...	...	...	55″
Length	...	...	...	...	...	60″
Weight	...	...	...	...	...	350 lbs.
Tusks	...	...	...	...	...	8½″

The weight seems immense.

W. St. JOHN RICHARDSON,
Captain, B. S. C.

Bombay, 30th January 1890.

TIGER CUBS.

It may perhaps interest the readers of the Journal to know that on the 21st instant, I took from inside a tigress, which I shot, *five* fully-formed young ones. They were rather smaller than newly-born fox-terrier puppies: three were males, two were females.

Mr. C. F. Pinney, of the Rifle Brigade, saw them at the time, and can corroborate what I write.

W. St. JOHN RICHARDSON,
Capt. B. S. C.

Bombay, 26th May 1890.

SNIPE SITTING IN THE OPEN.

Mr. Sinclair, in the last issue of the Journal, noted an instance of snipe sitting in the open. During the past cold weather I found them running about like sand-pipers on these occasions. Once on the edge of a jheel where they had plenty of cover, I saw 6 or 8 on the ground, and twice on the brink of village ponds I saw single birds feeding. In 1884 I witnessed a similar departure from their usual habits near Sialkote, and in 1876 near Secunderabad I came across a large wisp running about a newly-ploughed paddy-field. The latter were, if I remember right, " pintails"; all those seen on this side of India are " fantails."

G. J. RAYMENT,
A. V. D.

Babugarh, N.-W. P., 20th May 1890.

PANTHERS TREE'D BY WILD DOGS.

On the morning of the 25th March, as my friend C— and I were shooting small game along the bank of the Gogra river in the Neelghal, Berar, a native shouted, "Bagh hai, Sahib; Bagh hai;" so we went up to him. In a bend of the river, in a tree on a very high bank on the opposite side, was something black, and there were animals moving below.

Binoculars at once cleared the vision. There were two panthers in a " Sallai " tree, one above the other, with a large pack of 10 or 12 couple of jungle dogs moving about below.

The upper panther was resting across a branch, and the lower one holding on perpendicularly. The difficulty was to approach. It was arranged that C— should go above and have the shot, while I went below. After a bit the lower panther made a jump, pursued by the pack in my direction on the bank, but he broke up a ravine. Just then C— shot the other panther dead, but he stuck in a lower fork when he fell. Some of the pack immediately came back and could be seen standing on their hind legs and licking the blood as it streamed from the beast out of reach.

My friend C— would have shot two dogs, but he had a miss-fire. I only got two or three long shots at the dogs. The panther shot was a fine male about 7′ in length. The dogs made off, and we could not find the other panther.

Our informers said they saw the panthers treed at sunrise, and it was about 8 o'clock when we got there. This being the first instance I have known such a thing occur, I record it, as it will be interesting to sportsmen.

Chickalda, Berars, April 1890. FRED. WRIGHT.

PROCEEDINGS.

PROCEEDINGS OF THE MEETING HELD ON 31ST MARCH 1890.

The usual monthly meeting of the members of this Society took place on Monday, the 31st March, Dr. D. MacDonald presiding.

The following new members were elected:—Colonel E. Carrington of Poona, Raja Murli Monohur Bahadur, Mr. Maneckjee Cursetjee, Mr. Manekshah Jehangirshah Taleyarkhan, and Mr. Venakrao Luxumonjee.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions:—

CONTRIBUTIONS DURING FEBRUARY AND MARCH.

Contributions.	Description.	Contributors.
1 Snake	Dipsas gokool	Mr. G. Scaramanga.
1 Pallas' Shore Plover with 9 eggs..	C. mongolicus	Major J. H. Yule, R.A.
1 Hodgson's partridge with 12 eggs...	Perdix hodgsoniæ	Do.
Head of Thibetan Gazelle...	Gazella picticaudata	Do.
1 Cobra (alive)	Naga tripudians	Rev. Fr. Dreckmann, S.J.
1 Phoorsa (alive)	Echis carinata..................	Mr. O. Meyer.
2 Snakes (alive)	Passerita mycterizans	Do.
2 Dhamans (alive)	Ptyas mucosus.................	Do.
1 Mocking Bird (alive)......	......	Mr. C. H. Byrne.
1 Peacock	Pavo cristatus	Mr. Ameerudin Tyabji.
Eggs of painted partridge...	Francolinus pictus	Captain Shopland.
Nest of Palm Swift	Cypsellus batassiensis	Mr. H. F. Hatch.
1 Snake (alive)	Lycodon aulicus	Mr. M. C. Turner.
1 Skimmer......................	Rhynchops albicollis	Mr. E. L. Barton.
Mineralogical specimens ...	From Worli	Mr. I. Benjamin.
A number of Snakes, Lizards, Rats, &c...	From Raipore, C.P	Mr. J. A. Betham.

CONTRIBUTIONS TO THE LIBRARY.

"Bulletin de la Sociètè Zoologique de France,—pour l'année 1889-90," in exchange.

"New Commercial Plants" (Christy's) Nos. 2 to 6, presented by Mr. T. Lidbetter.

"The Indian Forester," Nos. 9 to 12, in exchange.

"Birds of India" (Oates), interleaved copy, Vol. I, presented by Mr W. F Sinclair, C.S.

"Catalogue of the Insecta," Part II, by E. T. Atkinson, presented by the author.

"Journal of Comparative Medicine," Vol XI, No. 2., in exchange.

"Monograph of Oriental Cicadidæ," by W. L. Distant, presented by the author.

"Records of the Geological Survey of India," Vol. XXIII, Part I, in exchange.

"Notes on the Pearl and Chank Fisheries of the Gulf of Manaar," presented by Edgar Thurston, the author.

"The proceedings of the Linnæan Society of New South Wales," Vol. IV, Part III, in exchange.

ELECTION OF AN HONORARY CORRESPONDING MEMBER.

The Honorary Secretary read a letter from Mr. R. C. Wroughton of Poona, in which he stated that professor Forel, of Zürich, had been of the greatest use to this Society in identifying the specimens of ants and other Hymenopterous insects sent to him for that purposes. It was proposed, and carried unanimously, that Professor, Förel be elected an honorary corresponding member of this Society.

ACCOUNTS FOR 1889.

Mr. E. M. Slater, the Honorary Treasurer, then laid before the meeting a Statement of Accounts for the year ending 31st of December last, showing that the Society had a cash balance on that date of Rs. 1,932-8-10. It was resolved that the accounts be accepted, subject to the audit of Mr. John Wallace.

BRANCHING TREE FERNS.

The Honorary Secretary read a note by Mr L. de Nicéville, of Calcutta, giving a description of a curiously bifurcated tree fern, which he had seen near Darjeeling.

DESTRUCTION OF THE PHURSA.

A letter was also read from Mr. R. E. Candy, C.S., Collector of Sholapore, containing an interesting account of his experiences when Collector of Rutnagherry, connected with the destruction of the Phursa (*Echis carinata*) in that district. Mr. Candy confirmed Mr. Vidal's recent statements on the subject, and strongly advised the Society to represent to Government the importance of destroying these dangerous snakes by adopting a more systematic system of reward.

Dr. J. C. Lisboa then read the first part of a valuable paper on Bombay Grasses, which appears in this number.

PROCEEDINGS OF THE MEETING ON 21ST APRIL 1890.

THE usual Monthly Meeting of this Society took place on Monday, the 21st April 1890, Mr. E. M. Slater presiding.

The following new Members were elected:—

Mr. T. H. S. Biddulph, Mr. E. A. Bulkley, Mr E. G. Oliver, Capt. W. F. Biscoe, Col. R. M. B. Thomas, and Mr. A Cooper.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions to the Society's collections:—

CONTRIBUTIONS DURING APRIL.

1 Snake, *Lycodon aulicus*, Mr. C. E. Kane.

1 Phoorsa (alive), *Echis carinata*, Mr. B. W. Blood.

Corallines from Prince's Dock, Mr. W. F. Lowe.

2 Peacocks (alive), *Pavo cristatus*, Mr. W. Hardie.

8 Crocodile's Eggs, *Crocodilus palustris*, Mr. R. P. W. Strong.

A number of snakes and reptiles, from Simla, Mr. A Newnham.

1 Scorpion, ten inches in length, Col. Thomas.

1 Owl (alive) *Strix javanica*, Mr. W. A. Menesse.

1 Flying squirrel, *Pteromys oral*, Mr. C. B. Collings.

1 Snake, *Simotes russellii*, Mr. F. Otto.

Some geological specimens from Karli, Mr. I. Benjamin.

1 Large wasp's nest from Gadawara, C. P., Mr. F. A. G. Simpson.

CONTRIBUTIONS TO THE LIBRARY.

"Silkworms in India," by E. C. Cotes, presented by the author.

A list of Irish birds in the Dublin Museum, from Mr. W. F. Sinclair, C.S.

The *Punjab Magazine*, No. 23, in exchange.

"Atlas of Practical Elementary Biology," from Mr. T. B. Kirkham.

A NEW FUNGUS.

The Honorary Secretary read a valuable communication from Dr. Barclay, of Simla, describing a new species of fungus (*Accidium Esculentum—Nov. Sp.*), found by Mr. Robert Wroughton, of Poona, growing on *Acacia eburnea*, Willd. A note by Dr. Prain on the same fungus was also read, and it was decided that the two papers should be published in the Society's Journal with the illustrations furnished by these gentlemen. Mr. J. H. Steel, A. V. D., then read the following paper entitled

POPULAR LESSONS FROM THE BOMBAY HORSE AND CATTLE SHOW, 1890.

Now that the rush and hurry of the Show itself is over and the animals have returned to their homes, it may not come amiss if we review the events of the Show and examine the exhibits with a view to determine what outcome, if any, there has been of the trouble and exertions necessary for carrying out such a Show.

We may pass by, as not needing further notice here, the satisfactory fact that the Princes and Chiefs of Western India conspicuously demonstrated their loyalty to the Queen-Empress by going to the expense, trouble, and risk of sending valuable animals to be exhibited on the occasion of Prince Albert Victor's visit; also the gratification which the Municipality must have derived from the undoubted success of its Victoria Gardens entertainment (which success we may fairly claim depended largely on the Horse and Cattle Show); also the satisfaction which all worthy citizens of Bombay must feel at what was practically the first horse and cattle show of this city, having been worthy of the *urbs prima.* What we want now is to examine the popular lessons of the Show; to see what benefit of a permanent nature the Bombay people have derived from it; the respects in which it has proved of educational value, and so has produced more influence than it could by the mere passing effect of pleasurable excitement and interest which it will have been to many.

A large proportion of the Bombay public had never seen a horse show, much less a cattle show; another proportion had never seen either a horse or cattle show in India; a few had seen the horse shows of the various parts of this Presidency, especially Poona and Ahmedabad; a very few had seen horse and cattle shows held locally, as in the Southern Mahratta States (Chinchli), in Guzerat, Kattywar, and elsewhere. Now the Bombay Show had a distinct and special object—"to collect as many of the best animals in India, horses and cattle, as may be procurable for the purpose of showing them to the Prince." There resulted from the efforts of the committee an assemblage of animals from several places, the outlying posts being Lus Beyla in Beloochistan, Bikanir and Kotah in Rajputana, Hissar in the Punjab, Bhadgaon in Khandeish, Hyderabad and Sholapore in the Deccan, and the Southern Mahratta States down south. No less than twenty ruling Princes and Chiefs of Western India sent animals to the Show. Though the Exhibition was thus very representative of Western India, the committee had reason to believe that, had more time been available, the whole of India might have been represented. Practically efforts were limited to one month before the Show, owing to uncertainty as to the exact form the reception of his Royal Highness should take. Let us represent in tabular form what we saw at the Show and what we might have seen :—

HORSES.

Source.	Seen.	Not seen.
European	English T. B.	
	N. T.	
	Cobs	
	Hunters	
	Hungarian and Blunts Arab	
Imported	Walers and New Zealanders, Arabs and Persian Kashgans.	Capes, Northerns, Cabulees.
Indigenous	Beluchi	Punjabi.
	Cutchi	Kurnaul C.-B's.
	Kattywari	Nizam's C.-B's.
	Bhimaturres	Mysore C.-B's.
	Kolhapore C.-B's	
	S. Mahratta C.-B's	
	Burmah	
Cross-breds	Arabs out of Kattywarris	
	Walers	
	C-B's	
	N. T. E. out of Cutchi	
	Arab out of Cutchi	
	out of Deccani	
	Kattywari out of Deccani	
	T. B. E. out of Cutchi	
	Kattywari	

CATTLE.

Source.	Seen.	Not seen.
European	English polled Angus Bull	Short horn and other breeds. Cows of various breeds.
Imported	Austrian Cow	Other European breeds. Aden Cows.
Indigenous	Beluchi	Sindi.
	Kankreji	Nellore.
	Gir or Kattywari	Danghi.
	Guzerathi	Punganur.
	Mysori	Kuneverya(?)
	Bhadgaon Khilari	Goranea(?)
	Krishna Valley	Burmah.
	Deccani	Malwar.
	Wadias	Cauvery Valley.
	Gainias	C. P. Cattle.
Cross-breds	Hissar	Berars Cattle.
	Guzerati out of Huryan	
	English by Cutchi	
	Mysore by Deccani	
	Buffaloes Jaffarabadi	
	Delhi	
	Deccani	
	Soorti	
	Deshi	

Little Fram, Mr. Adenwalla's remarkable pony, which was commended as a curiosity, was said to have come from Australia and to have arrived there from Shetland, but there seemed a doubt as to his origin. He was practically full-grown, and contrasted remarkably with Mr. Heeramaneck's grey walers, for example. He was more probably a dwarf, representative of the ordinary race of horses, rather than one of a race of equine pigmies. His measurements were found to be fairly in proportion, though to a horseman's eye he was not handsome. The class of miscellaneous exhibits was improvised, as the exhibition of saddlery, harness, &c., fell through in the rush of organisation. In this class were placed the Rajah of Bikanir's camels, Little Fram, a dumb sheep, and a few other things, including the gorgeous horn-covers and trappings of a superb pair of bullocks sent up by H. H. the Gaekwar of Baroda. The educational benefits resulting from the Show have not been confined to those obtained by the general public. Exhibitors and their servants must have benefited by comparison of their animals with those from other parts of the country. Veterinary students have had a most valuable experience, and details have been collected which will be embodied in a scientific record of the Show. It will be seen that the breeds represented far outnumber those unrepresented, and there is every reason to believe that with a little more time many of the blanks, especially as regards cattle, might have been filled up. In some cases the sub-division into breeds went further than above indicated, and I am writing to our active coadjutor, Colonel Nutt, for favour of information concerning the terms applied in Kattywar and Northern Guzerat to families of horses, cattle, and buffaloes, especially as regards the meaning of some terms inserted in the official catalogue, which to me are obscure. Bombay may congratulate itself on having seen a most exceptional collection of indigenous and imported horses and cattle, also of cross-breeds, and on an opportunity for comparison of results of breeding operations in Western India, such as has not occurred before and will be long before it occurs again. People who talk in a light-hearted manner of animal shows in Bombay are hardly aware of the exceptional circumstances under which the 1890 Show has been organized, nor of the amount of work and responsibility involved in it. At any rate, some of the secretaries can look back on the week of the Show as the busiest in their lives.

Consideration of the awards shows that—

1. The general stamp of exhibits was of high class, 32 per cent. being rewarded.
2. The cattle were, as a whole, considered more highly than the horses, 38 per cent.
3. Of the horses and ponies, Bombay contributed roughly one-third; and of the cattle, about an equal proportion.
4. Bombay exhibits were a few Walers, a good show of Arab horses and ponies, some useful draught cattle, and some valuable buffalo-cows.
5. The Princes and Chiefs mainly exhibited in the European and country-bred classes of the horses in all classes of cattle.
6. From the northern parts represented in the Show, the horses principally obtained prizes.
7. From the southern parts represented in the Show, cattle principally obtained prizes.
8. The Government of India (Commissariat Department) and the Government, of Bombay took prizes for cattle.
9. A colt by a Bombay Government sire took first prize in the young stock class.
10. The driving classes (cattle) were a failure.
11. Bombay was well represented in the driving, jumping, and turn-out classes, showing that as regards horsemanship the Bombay people make the most of the time, space and climate at their disposal.
12. The Bombay Municipality was well represented in the bullock class.

On the whole, I take it, the Show was representative of Bombay as well as of the west of India. The Waler classes were weak, the Arab classes, country-bred, and young stock classes were necessarily dependent on supplies from up-country. As regards cattle, bullocks, buffaloes, cows, and gainias came from Bombay, breeding stock and agricultural bullocks from up-country. To the happy combination of classes from local and exterior source, must be attributed the general success of the Show. The weakness of the important cattle classes, and the cattle driving, were more than compensated for by the fine show of Arabs, country-breds, and ponies, the good muster of indigenous cows, bulls, bullocks, and buffaloes, and the enthusiasm in the horse driving and turn out classes—possibly a larger number of tandems and of jumping ponies might have turned up, but on the whole the entries were gratifying. There can be no doubt the Bombay public fully appreciated the novel sight of a horse and cattle show in the island, and in the main those who were concerned in its organization must be gratified with the result.

AN ALBUM OF THE PRIZE ANIMALS.

Mr. Steel informed those present that all the animals at the Show had been photographed, and that the pictures when bound together in an album, with printed descriptions, would form a most valuable means of comparing the different breed of horses and cattle.

The Chairman proposed a vote of thanks to Mr. Steel for his paper, and complimented him on the successful manner in which he and those who had worked with him had carried out the organization of the Show.

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No. 3.] BOMBAY, 1890. [Vol. V.

ON NEW AND LITTLE-KNOWN BUTTERFLIES FROM THE INDIAN REGION, WITH DESCRIPTIONS OF THREE NEW GENERA OF HESPERIIDÆ.

By Lionel de Nicéville, F.E.S., C.M.Z.S., &c.

(With Plates D and E.)

Family NYMPHALIDÆ.

Subfamily Satyrinæ.

1. RAGADIA CRITO, n. sp., Pl. D, Figs. 1, ♂; 2, ♀.

Habitat: Bhutan.

Expanse: ♂, 1·9; ♀, 2·0 inches.

Description: Male. Upperside, *both wings* rather deep powdery dead black, crossed by four obscure much sullied whitish bands; the first near the base of the wings the most indistinct, reaching almost to the costa of the forewing about the middle; the second is rather more prominent, ending on the forewing at the costal nervure about one-fourth of the length of the wing from the apex; the third the broadest and most distinct, not quite reaching the apex of the forewing; the fourth submarginal, narrow on the forewing, broader on the hindwing: in addition to these four bands there is a very indistinct marginal pale line. Underside, *both wings* with all the bands pure white and very prominent; the portion of the black ground-colour between the third and the fourth white bands of the upperside bearing a series of more or less conjoined ocelli, black with large silvery pupils, and outwardly defined by a narrow yellow line; the marginal white line narrow, regular, and very prominent. *Forewing* with an additional short white band at the base. FEMALE, *both wings* broader and more rounded than in the male. UPPERSIDE, *both wings* with all the bands broader and clearer white, though still sprinkled with black scales. UNDERSIDE, *both wings* as in the male.

Nearest to *R. crisilda*, Hewitson, which occurs not uncommonly in several parts of Assam and Burma. Differs from that species in the different shade of the black coloration of the upperside, and in all the bands being strongly sullied (especially in the male). In *R. crisilda* the third band from the base of the wings is pure white, as is the fourth band on the hindwing, which latter also is much narrower.

I am indebted to Mr. Fritz Möller for the gift of a pair of specimens of this species, obtained last October by his native collectors in Bhutan, where it appears to be by no means uncommon.

Ragadia is a small and compact Indo-Malayan genus. One species occurs in Bhutan; a second in Assam and Burma; *R. crisia*, Hübner, is found in the Malay Peninsula, Sumatra, Bantam, Java, and Borneo; Mr. Grose Smith has also described *R. annulata* from the Kina Balu Mountain, in north Borneo; while Herr George Semper in his "Schmett. der Philipp. Inseln," gives three species *R. crohonica*, Semper, and *R. luzonia* and *melindena*, Felder, from the Philippine group of islands.

Subfamily MORPHINÆ.

2. ELYMNIAS CHELENSIS, n. sp., Pl. D, Fig. 3, ♂.

HABITAT: Khasi Hills.

EXPANSE: ♂, 2·7 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* fuscous-brown. *Forewing* with the basal half of the costa and the outer margin narrowly ferruginous, the rest of the wing strongly glossed with rich deep blue, becoming obsolete basally; two large conjoined equal-sized oblong pale blue spots occupying the whole middle third of the discoidal interspaces; two similar but smaller spots in the median interspaces not nearly reaching the bounding nervules of the interspaces they occupy. *Hindwing* entirely unglossed with blue; the fuscous-brown ground-colour becoming lighter towards the outer margin; extreme outer margin ferruginous. UNDERSIDE, *both wings* castaneous, sprinkled with purplish and white. *Forewing* with the white mottlings concentrated into an oblique discal band, which commences on the costa at a short distance from the extreme apex of the wing and ends at the first median nervule, where the speckles are more scattered and larger, and with the mottling extended one-fourth along the costa from the apex; inner margin dull fuscous, extending on to the disc beyond the oblique discal mottled band and ending in a point at the third median nervule. *Hindwing* divided into two equal well-defined areas, the basal area rich castaneous sparsely sprinkled with dull purplish, the outer area so thickly sprinkled with purplish that the castaneous ground-colour is almost obliterated; a large oval pale ochreous spot in the middle of the upper subcostal interspace; an outer-discal or submarginal series of five minute black dots inwardly marked with a minute white dot, one in each interspace.

Closely allied to *E. penanga*, Westwood, from the Malay Peninsula, from which it differs in the apex of the forewing being more produced, the outer margin less scalloped, the apex of the hindwing also more produced, the outer margin considerably truncated and entire; in the markings of the costa of the forewing and of the outer margin of both wings on the upperside being ferruginous, instead of concolorous with the rest of the wings as in *E. penanga*; in the forewing having four instead of five spots, owing to the posterior one being absent; in the two anterior spots being shorter, wider, and conjoined instead of well separated; in the hindwing being entirely unglossed with blue, whereas in *E. penanga* it is strongly blue-glossed; in the markings of the underside of both wings being more variegated, and in the presence of the large subcostal spot of the hindwing which is not to be found in *E. penanga*.*

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* This is not always the case, as Mr. Distant describes and figures this spot in describing *E. penanga*, *vide* his Rhop. Malay., p. 63, n. 5, pl. vii, fig. 6, *male* (1882), and it is shewn also in Mr. Hewitson's figure of the species (*Melanitis mehida*, Hewitson, Ex. Butt., vol. iii, *Melanitis* pl. i, figs. 2, 3, *male* (1863), though it is entirely absent in the three specimens of this species I possess from the Malay Peninsula.

E. chelensis is also allied to *E. sumatrana*, Wallace, from Sumatra, and to *E. konga*, Grose Smith, from the Kina Balu Mountain, North Borneo, which latter is said to have a rather small white subcostal spot on the underside of the hindwing "which is absent in *E. penanga* and *E. sumatrana*."

Described from two specimens in the collection of the Rev. Walter A. Hamilton, by whose native collectors it was captured at Chelapunji, at the foot of the Khasi Hills, on the Sylhet side, at nearly sea-level, whence most of the butterflies recorded from the Khasi Hills are obtained.

3. DYCTIS DÆDALION, n. sp., Pl. D, Fig. 4, ♀.

HABITAT: Myitta, Burma.

EXPANSE: ♀, 2·65 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* dull reddish-brown, almost fuscous; crossed by a broad pure white band, beyond which the ground-colour is somewhat obscurely striated with paler. *Forewing* with the costa striated with white; the broad white band slightly outwardly curved, commencing on the costa at the middle, of even width as far as the third median nervule, then rapidly decreasing in width to the anal angle, its lower portion somewhat sullied, especially at the edges. *Hindwing* with the broad white band extending from the costa to the abdominal margin, widest in the middle, rather narrow at the costa; bearing outwardly a series of five round black spots, of which the two upper ones divided by the discoidal nervule and the one in the submedian interspace are the smallest, and those divided by the second median nervule about four times as large. UNDERSIDE, *both wings* with the basal half dull castaneous coarsely striated with whitish; the outer half white, very densely and coarsely striated with dark castaneous, especially on the outer margins; the broad discal white band as on the upperside. *Hindwing* with an additional very small bluish spot outwardly defined with black in the upper subcostal interspace near its base.

D. dædalion belongs to the group of which *D. panthera*, Fabricius, from Java, is the type, and of which *D. singhala*, Moore, from Ceylon, *D. lutescens*, Butler, from the Malay Peninsula, Sumatra, and Borneo, *D. dolorosa*, Butler, from the Island of Nias, and

D. mimus, Wood-Mason and de Nicéville, from the Nicobar Isles, are offshoots. The outline of the wings is nearly as in *D. lutescens*. *D. dædalion* differs from all these species prominently in the presence of the broad pure white band across both wings, and in other minor details.

I am indebted to Mr. B. Noble, of the Phayre Museum, Rangoon, for the loan of the unique type example. It was taken at Myitta in January. Major C. H. E. Adamson informs me that he obtained a female in August, 1881, at Tavoy.

Subfamily NYMPHALINÆ.

4. NEPTIS NYCTEUS, n. sp., Pl. D, Fig. 7, ♂.

HABITAT: Sikkim.

EXPANSE: ♂, ♀, 2·6 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* black; *cilia* white, more or less tipped with black at the ends of the veins. *Forewing* with a large narrow white discoidal streak sullied with ochreous at the edges occupying the posterior half of the discoidal cell; immediately below the apex of this streak is an elongated pure white spot in the second median interspace, and a considerably smaller almost round spot below it in the first median interspace; this spot is well separated from an oblique spot extending from the middle of the submedian interspace to the inner margin, and divided by the submedian nervure into two portions; four small sullied white spots beyond the end of the cell from the costa to the lower discoidal nervule divided by the veins; beyond these are three subapical spots placed obliquely, the upper one on the costa much the smallest, the middle one below it much larger, its edges sullied with ochreous, the lowermost spot half the size, round, and placed in the upper discoidal interspace; an indistinct pale submarginal line. *Hindwing* with a broad white discal band from the first subcostal nervule to the middle of the abdominal margin; a submarginal increasing somewhat macular much sullied whitish band. UNDERSIDE, *both wings* highly variegated, having bands of pure white, bluish, yellow, castaneous, and black, so that it is very difficult to describe the coloration in detail, as one colour runs into and blends with those adjoining it.

Forewing with the basal half of the costa yellow, beyond which is a broad band of castaneous ground-colour; the discoidal streak and the white spots in continuation pure white but much broader than on the upperside; the four small spots beyond the cell much larger than above and pale bluish; the subapical spots as above, but their edges less well marked; a yellow patch of ground-colour near the apex of the wing; the submarginal line anteriorly yellow, in the middle bluish, posteriorly white. *Hindwing* with a subcostal bluish streak outwardly broken; the discal white band as above, followed by a broad castaneous band bearing a narrow yellow line; the submarginal band of the upperside much broader and bluish-white: the outer margin yellow becoming castaneous at the apex. FEMALE. UPPERSIDE, *forewing* has the spot in the second median interspace very narrow, touching the second median nervule, and well separated from the discoidal streak, of exactly the same length as the spot below it,which latter is bounded above and below by the second and first median nervules, the two spots together forming a perfectly quadrangular oblong figure; otherwise as in the male. *Hindwing* with the discal band narrower than in the male; the submarginal band wider, pure white instead of sullied. UNDERSIDE, *both wings* very much paler than in the male, the castaneous bands almost obliterated, the ground-colour mostly very pale yellow.

Nearly allied to *N. narayana*, Moore, from the Western Himalayas, differing in the male on the upperside of the forewing in the discoidal streak being separated from the spot in the second median interspace only by the black vein, and in the spot in question being consequently much larger; in the underside being much more richly variegated; and in the presence of the castaneous and black patches of ground-colour, which are entirely wanting in *N. narayana*. The female differs in the colour of the ground of the underside, which is mainly pale yellow instead of "glossy ferruginous."

The type male specimen in Mr. G. C. Dudgeon's collection was taken in June; the type female in my own collection was taken in July; and a second female specimen in Mr. A. V. Knyvett's collection—were all taken at Tongloo on the Singalelah range at an elevation of about 12,000 feet.

5. EUTHALIA ELICIUS, n. sp., Pl. D, Fig. 8, ♂.

HABITAT: Burma.

EXPANSE: ♂, 2·5 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich glossy bronzy brown. *Forewing* with a narrow black line towards the base of the discoidal cell, a double line across the middle and extending just below it, a similar double line closing the cell; a discal waved line, and a very indistinct submarginal (outer discal) similar line. *Hindwing* with a double black line at the end of the cell, discal and submarginal lines as in the forewing, the abdominal margin pale. UNDERSIDE, *both wings* ochreous, gradually increasing in intensity towards the outer margins of the wings. *Forewing* with the markings in the cell as on the upperside, the two discal lines very faint. *Hindwing* marked as above, but all the markings partially obliterated.

E. elicius appears to be nearest to *E. jahnu*, Moore (the male described as a distinct species by Moore as *sananda*), with which it agrees almost exactly in the markings of the upperside except that they are rather less distinct; but it entirely lacks the vinous suffusion which is such a marked and peculiar character in *E. jahnu*. On the underside also the markings are similar though much less prominent, but the ground-colour is of a much less ferruginous shade and is altogether paler. *E. elicius* reminds one a little of Distant's figure* of *E. parta*, Moore, but does not at all resemble Moore's original figure of that species.

A single example taken at Myitta, Burma, in February, is deposited in the Phayre Museum, Rangoon.

Family LEMONIIDÆ.

Subfamily LIBYTHÆINÆ.

6. LIBYTHEA GEOFFROYI, Godart, Pl. D, Fig. 5, ♂.

L. geoffroy, Godart, Enc. Méth., vol. ix, p. 813, n. 5-6 (1823); idem, id., Mém. Soc. Linn. Par., vol. ii, Lép., pl. ii (1823); *L. geoffroyi*, Wallace, Trans. Ent. Soc. Lond., 1869, p. 335, n. 4; id, Kirby, Syn. Cat. Diurn. Lep., p. 283, n. 8 (1871).

HABITAT: Java (*Godart*), Timor, Flores (*Wallace*); Burma.

EXPANSE: ♂, ♀, 2·4 inches.

DESCRIPTION: MALE. UPPERSIDE, *forewing* brownish-fuscous; the posterior two-thirds of the discoidal cell and the basal two-thirds of the wing from the third median nervule to the inner margin shining violet, bearing at the end of the cell and in the median interspaces slightly paler spots, caused by the white spots of the underside shewing through by transparency; a small cordate white spot in the interspace between the subcostal nervure and upper discoidal nervule, beyond and below which are two similar spots placed one below the other divided by the lower discoidal nervule. *Hindwing* pale brown, the immediate base glossed with pale violet; a discal fascia composed of three dull orange spots from the second median to the lower subcostal nervule. UNDERSIDE, *forewing* pale brown, dark brown on the disc, the costa and apex of the wing widely grey, irrorated with fine black dots; the cell almost entirely occupied by a broad ochreous streak; the three subapical spots as on the upperside, but the two lower of these spots connected by a minute spot placed between them; two discal white spots outwardly defined by pale ochreous placed in the middle of the median interspaces; the upper one small and elongated; the lower large and quadrate, fully four times as large as the upper. *Hindwing* greyish-brown, profusely mottled throughout with blackish; an obscure oblique paler band extending from about the middle of the costa to the middle of the cell, its outer edge marked with a prominent black dot at the base of the second subcostal nervule; a somewhat quadrate similar spot in the middle of the subcostal interspace; and a discal band coincident with the dull orange macular band of the upperside, but more extended, nearly reaching the outer margin. FEMALE. UPPERSIDE, *forewing* with the violet area duller and confined to the immediate base of the wing; a quadrate white spot at the end of the discoidal cell; a tripartite subcostal spot; another elongated spot from the third median to the upper discoidal nervule, placed outwardly below it; a large quadrate discal spot completely filling the interspaces between the first and third median nervules. *Hindwing* with no violet gloss at the base, otherwise as in the male. UNDERSIDE, *forewing* with the cell orange but outwardly terminated by a large white spot the other spots as on the upperside. *Hindwing* as in the male, but all the markings more obscure.

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* Rhop. Malay., p. 437, n. 18, pl. xxxvii, fig. 7, *male* (1886).

Described from three males and one female from Syinbyudine, on the Tavoy-Siam frontier, taken in December, 1888, and January and March, 1889. One pair is deposited in the Phayre Museum, Rangoon, two males are in my own collection.

I submitted the drawing of the male reproduced here to Dr. O. Staudinger of Dresden, who writes that it agrees exactly with a specimen in his collection from Timor, but that most of the Timorean specimens do not show the three white subapical spots of the forewing, nor the dull orange macular band of the hindwing on the upperside. It agrees very well with the description of the species by Godart. It probably more or less mimics one of the blue *Euplœas* when flying; when at rest its mottled underside, so like that of a dead leaf, proves of sufficient protection. All *Libytheas* rest with closed wings, usually at the end of a dead branch or stick, when they are very difficult to see, unless they have been actually observed to settle. The occurrence of this species on the mainland of Asia is most interesting, as hitherto *L. geoffroyi* and several named and described local races have only been found in the islands of the Malay Archipelago.

7. LIBYTHEA LIBERA, n. sp., Pl. D, Fig. 6, ♂.

HABITAT: Burma.

EXPANSE: ♂, 2·2 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich glossy brown, rather paler towards the base. *Forewing* with an oblique oval whitish spot outwardly faintly defined with ochreous at the end of the discoidal cell; a similar round spot in the middle of the first median interspace; a tripartite subcostal white spot placed about midway between the end of the cell and the apex of the wing, its uppermost portion a mere dot, its middle portion twice the size, its lowermost portion quadrate and very much larger; two rounded spots placed outwardly and below the subcostal spot, divided by the lower discoidal nervule. *Hindwing* with a large quadrate whitish spot on the middle of the costa; an oblique discal macular ochreous band formed of four portions, the one towards the apex of the wing the largest. UNDERSIDE, *forewing* fuscous-brown, the apex paler and mottled with whitish; the spots as above, but the subcostal spot completely amalgamated; the basal half of the cell occupied by a dull ochreous band. *Hindwing* glossy purplish-brown, heavily striated with white; an oblique quadrate white spot on the middle of the costa bounded posteriorly by the first subcostal nervule; a white increasing streak from near the base of the wing extending to the middle of the wing placed on the subcostal nervure; an oblique narrow whitish band extending from near the abdominal margin to near the apex of the wing, coincident with the ochreous macular band of the upperside.

Very near to *L. narina*, Godart, from Ceram, Gilolo, the Philippines, and the Khasi Hills (=*L. rohini*, Marshall), differing from Indian specimens of that species, however, in its considerably larger size, the spot in the cell and the one below it in the first median interspace of the forewing not being "pure white" but outwardly defined with ochreous; the discal band on the hindwing ochreous instead of pure white, and more macular; and the cilia throughout concolorous with the wings instead of whitish. The underside is darker, the white striations much less numerous.

Described from a single specimen taken at Syinbyudine on the Tavoy-Siam frontier in December, and now deposited in the Phayre Museum, Rangoon.

Family LYCÆNIDÆ.

8. GERYDUS GOPARA, de N., Pl. E, Figs. 1, ♂; 2, ♀.

G. gopara, de Nicéville, Butt. of India, vol. iii, p. 25 (1890).

Habitat: Perak; Jelebu; Johore; Singapore—all in the Malay Peninsula; Padas River, North Borneo.

Expanse: ♀, 1·4 inches.

Description: Female. Differs from the male in the apex of the forewing being much less produced, thus giving the wing a much blunter and squarer appearance. Upperside, *both wings* marked similarly to the male. Underside, *forewing* with all the spots smaller, especially the subapical series, which is reduced to three dots.

Described from three examples kindly sent me by Mr. W. Davison, the Curator of the Raffles Museum, Singapore.

9. ZARONA PHARYGOIDES, n. sp., Pl. E, Fig. 3, ♂.

Habitat: Malay Peninsula.

Expanse: ♂, 1·35 inches.

Description: Male. Upperside, *both wings* black, with a large patch of rich ultramarine-blue turning to brilliant emerald-green in some lights on each wing. *Forewing* with the blue patch extending from the median nervure to the inner margin, and formed of the following portions:—a very minute portion at the base of the second median interspace; a much larger portion at the base of the first median interspace; an elongated portion filling the base of the submedian interspace, but, opposite the point where the second median nervule arises, the blue patch is suddenly deflected downwards and occupies the posterior half of the interspace, instead of as before being bounded anteriorly by the first median nervule; the fourth portion occupying the whole of the basal three-fourths of the internal interspace, but not reaching as near to the outer margin as the portion anterior to it does. *Hindwing* with the blue patch wedge-shaped or triangular, the apex at the base of the wing, its base bounded by the outer margin, which it does not quite reach, thus leaving the costal and abdominal margins broadly and the outer margin narrowly black; the median nervules outwardly bearing a pear-shaped black spot, between which on the margin are a series of very small black spots indenting the blue area. UNDERSIDE, *both wings* pale reddish, bearing an outer-discal dark line outwardly defined with whitish, highly irregular and zig-zagged on the hindwing, less so in the forewing, where it is broken at the third median nervule, its anterior short portion shifted outwards; two submarginal irregular broad indistinct dark red bands. *Forewing* with a linear black spot close to the anal angle. *Hindwing* with some scattered white scales towards the anal angle inwardly defined by a fine black line, and a very narrow marginal white line, outwardly defined by an anteciliary dark red line.

Nearest to ? *Z. pharyge*, Hewitson, from Borneo, from which it is at once separated by the much greater extent of blue (or green as the case may be) coloration on the upperside of both wings, and especially by the absence of the submarginal series of five spots and the trifid subapical spot on the forewing. In coloration and markings it appears to agree very closely with *Deramas livens*, Distant,*from Singapore, but differs from it structurally in not possessing the "cellular tuft of long hairs" present in the hindwing on the upperside of that species. It is also near to *Z. bradamante*, Doherty, MS., from Lower Siam,† but in that species the blue coloration on the upperside of the forewing is said to extend into the discoidal cell; nor does

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* Rhop. Malay., p. 451, n. 1, pl. xlii, fig. 15, *male* (1886).

† Butterflies of India, vol. iii, p. 36 (1890).

Z. pharygoides possess the "oblique dark streak in the green in the middle of the interno-median interspace, and a longer one along its upper edge," said to be present in *Z. bradamante*.

Described from two examples from Johore in the Malay Peninsula kindly forwarded to me by Mr. W. Davison.

10. ZEPHYRUS KHASIA, de N., Pl. E, Fig. 4, ♂.

Z. khasia, de Nicéville, Butt. of India, vol. iii, p. 301, n. 863 (1890).

HABITAT: Khasi Hills.

EXPANSE: ♂, 1·55 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich metallic green, the veins black, the outer margins with a broad regular black border. *Forewing* with the costa very narrowly black, the outer black border broadest at apex. *Hindwing* with the costal margin broadly black, the outer margin waved; no tail, but the termination of the first median nervule slightly produced tooth-like. UNDERSIDE, *both wings* silvery-white. *Forewing* with a fuscous bar closing the discoidal cell, a discal curved and waved fuscous band from the costa to the first median nervule, its outer edge sharply defined, its inner edge somewhat diffused; a submarginal increasing macular fuscous band from near the costa to the submedian nervure, becoming obsolete before it reaches the costa. *Hindwing* with a faint darker line defining the disco-cellular nervules; a discal sinuous macular fascia composed of narrow fuscous fragments outwardly defined with whitish placed between the veins; a submarginal increasing series of six fuscous lunules placed between the veins; an anteciliary fuscous line, becoming obsolete towards the costa. *Cilia* white, becoming fuscescent towards the apex of the forewing.

Nearest to *Z. saphirina*, Staudinger, from Corea and Japan.

Described from a single example in the collection of the Rev. Walter A. Hamilton.

11. BIDUANDA SCÆVA, Hewitson, Pl. E, Fig. 7, ♀.

Myrina scæva, Hewitson, Ill. Diurn. Lep., p. 30, n. 11, pl. xv, figs. 39, 40, *male* 1863); *Biduanda scæva*, de Nicéville, Butt. of India, vol. iii, p. 428 (1890).

HABITAT: Singapore.

EXPANSE: ♀, 1·0 inch.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* dull fuliginous-black. *Forewing* unmarked. *Hindwing* with a large irrorated white patch on the anal region divided by the dark veins, extending from the anal angle to the third median nervule, bearing outwardly an oval black spot in the first median and submedian interspaces, and a very fine black anteciliary line; *tails* white, medially black. UNDERSIDE, *both wings* white. *Forewing* with the apical third dull ochreous-ferruginous, with the following fuscous markings:—a dot at the extreme base of the discoidal cell, a large quadrate spot beyond reaching to the submedian nervure, a third narrower spot beyond again also extending across the submedian interspace, a narrow streak on the disco-cellular nervules, a short macular band beyond the cell from the third median nervule to the costa, an irregular macular discal band, a submarginal waved line, and some spots and dots along the costa. *Hindwing* with a cluster of about eight spots occupying the basal third of the wing, a discal fascia composed of narrow lines in pairs between the veins, the two anterior pairs solid, a fine submarginal lunular line enclosing a series of spots between the veins, the one in the first median interspace very large and intensely black, inwardly defined by a line of metallic pale greenish-blue scales, which are continued to the abdominal margin; the anal lobe bearing a small black spot, a very fine black anteciliary line. *Cilia* of the forewing black, of the hindwing white.

Described from a single example without locality, but probably from the Malay Peninsula.

12. BIDUANDA CINESOIDES, de N., Pl. E, Fig. 8, ♀.

B. cinesoides, de Nicéville, Journ. Bombay Nat. Hist. Soc., vol. iv, p. 166, n. 5, pl. A, fig. 7, *male* (1889); idem, id., Butt. of India, vol. iii, p. 428 (1890).

HABITAT: Selangore, Jelebu, both in the Malay Peninsula.

EXPANSE: ♀, 1·6 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* dull fuliginous-black. *Forewing* unmarked. *Hindwing* bearing outwardly a large pure white band from the submedian nervure almost to the outer margin reaching just beyond the third median nervule, the band on both edges constricted where crossed by the veins; followed by an almost similar band of the ground-colour, and then by an outer narrower white band. *Tails* pure white. *Cilia* of the forewing black, of the hindwing anteriorly black, posteriorly white, inwardly defined by a narrow black line from the base of the short tail to the anal angle. UNDERSIDE, *both wings* marked as in the male.

Much larger than the same sex of the Bornean *B. cinesia*, Hewitson, and differing altogether in the character of the white markings on the upperside of the hindwing.

Described from a single specimen from Jelebu.

13. RAPALA DELIOCHUS, Hewitson, Pl. E, Fig. 6, ♀.

Deudorix deliochus, Hewitson, Trans. Ent. Soc. Lond., 1874, p. 352; idem, id., Ill. Diurn. Lep., Suppl., p. 31, n. 36, pl. *va*, figs. 68, 69, *male* (1878); *Rapala deliochus*, de Nicéville, Butt. of India, vol. iii, p. 457, n. 991 (1890).

HABITAT: Rangoon.

EXPANSE: ♀, 1·5 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* with the blue coloration of a duller shade than in the male, and of greater extent. *Forewing* has the disco-cellular nervules marked with a black line. *Hindwing*, the blue colour does not nearly reach the outer margin as it does in the male, and all the veins are black. UNDERSIDE, *both wings* marked as in the male.

Described from two female specimens obtained in June and August by Mr. B. Noble, Curator of the Phayre Museum, Rangoon, who sent them to me for identification.

14. RAPALA SCINTILLA, de N., Pl. E, Fig. 5, ♂.

R. scintilla, de Nicéville, Butt. of India, vol. iii, p. 461, n. 997 (1890).

HABITAT: Sikkim.

EXPANSE: ♂, 1·4 to 1·6 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* very dark indigo-blue. *Hindwing* with a patch of most magnificent iridescent blue on the disc beyond the end of the discoidal cell not quite reaching the outer margin, bounded posteriorly by the first median nervule, anteriorly extending just above the second subcostal nervule; inner margin pale fuscous heavily clothed with long fuscous setæ; anal lobe bearing a very small orange spot. UNDERSIDE, *both wings* greenish-grey; two fine darker grey lines defining the disco-cellular nervules; a similar discal line, outwardly bounded by a fine white line, slightly outwardly curved in the forewing, extending from the costa to the submedian fold, more curved and somewhat irregular in the hindwing, recurved to the abdominal margin; an obscure submarginal band. *Hindwing* with a large black spot crowned with a fine white line on the anal lobe, a smaller similar spot crowned with a fine orange line in the first median interspace, the space between these two spots sprinkled with black and white scales; a very fine anteciliary black line; *cilia* grey; *tail* black, tipped with white. FEMALE unknown.

R. scintilla in the male may at once be distinguished from *R. schistacea,* Moore, by the absence of the blue gloss on the forewing on the upperside; from *R. orseis,* Hewitson, it may be known by the presence of the blue gloss on the hindwing. *R. scintilla* therefore appears to occupy a position exactly intermediate between these two species. The greenish-grey shade of the underside is also distinctive.

Described from six examples in Mr. A. V. Knyvett's collection and my own.

Family HESPERIIDÆ.

15. ISOTEINON IAPIS, n. sp., Pl. E, Fig. 9, ♂.

HABITAT: Burma, Malay Peninsula.

EXPANSE: ♂, 1·5 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* dark shining brown, becoming of a deeper shade towards the outer margins. *Forewing* with the following semi-transparent lustrous yellowish spots:—two towards the end of the discoidal cell, the upper one a round dot, the lower larger, elongated, comma-shaped; a pair of conjoined subapical dots divided by the terminal portion of the subcostal nervure (which in the *Hesperiidæ* appears always to end on the outer margin some little distance below the apex), the lower a little the larger; three discal spots placed obliquely, the upper one in the lower discoidal interspace a mere dot, equal in size to the lower subapical dot, the middle spot in the upper median interspace about four times as large, its outer edge concave, its inner convex, the lowest spot about four times as large as and shaped like the spot above, placed in the first median interspace. *Hindwing* unmarked, but the abdominal margin and especially the anal angle fringed with very long hairs. UNDERSIDE, *both wings* much paler than above, sprinkled throughout thickly with dull ochreous scales. *Forewing* with the inner margin broadly pale yellow, a tuft of long black hairs attached to the margin. *Hindwing* with a discoidal and four or five discal small very obscure dark spots, which appear to be formed by a portion of the ground-colour being left free from the dull ochreous scales. *Antennæ* above entirely fuscous, beneath with an increasing yellowish streak towards the apex, not extending to the extreme tip. *Cilia* of the forewing concolorous, of the hindwing cinereous.

Apparently nearest to *I. subtestaceus*, Moore,* of which there is one of the original specimens from Upper Tenasserim taken by Mr. Ossian Limborg in 1876-77 in the collection of the Indian Museum, Calcutta. Differs therefrom in having two spots instead of one in the discoidal cell of the forewing, two instead of three subapical dots, three instead of two discal spots, which latter also differ widely in size, shape, and position. The coloration of the underside is also quite different.

The type specimen of *I. iapis* is from Johore in the Malay Peninsula, and was kindly forwarded to me by Mr. W. Davison. In the Indian Museum, Calcutta, are two small specimens taken by Dr. J. Anderson in the Mergui Archipelago on 11th December, 1881, and 11th April, 1882, respectively, which are undoubtedly the same species, though too worn to be identified by Mr. Moore when working out the collection of which these specimens formed a part. On one of them Mr. Moore placed a ticket on which is written "not *moolata*," which is, however, a *Parnara*, and not an *Isoteinon*.

Genus AËROMACHUS, nov.

Both wings very small. Forewing, triangular, *costa* quite straight, *apex* acute, *outer margin* gently convex, *inner angle* rounded, *inner margin* straight, longer than the outer margin; *costal nervure* ending about opposite the apex of the discoidal cell, well separated from the costa, bent upwards to the costa towards its end; base of *second subcostal nervule* nearer to base of first than to base of third, *fourth* subcostal arising very near to the base of third, reaching the apex of the wing; terminal portion of *subcostal nervure* (often called a fifth subcostal nervule) ending on the outer margin considerably below the apex of the wing; *upper disco-cellular nervule* short, stout, outwardly oblique, straight; *middle* disco-cellular sinuous; *lower* disco-cellular shorter than the middle, straight, in the same straight line with the middle, inwardly oblique; the *median* nervules with their bases equi-distant, given off very near to the end of the cell, the third median originating at the point where the lower disco-cellular nervule meets the median nervure; the *median nervure* strongly bent upwards from the base of the second median nervule; *submedian* nervure straight. MALE (in the type species only) with a broad oblique stripe of modified scales on the upperside extending from the middle of the submedian nervure to the base of the second median nervule. HINDWING, much rounded throughout; *costa* short; *costal nervure* almost straight, *first subcostal nervule* bent upwards at base, thence straight to apex of wing; *subcostal nervure* strongly bent downwards between the bases of the subcostal nervules, giving the appearance of a third (or upper) disco-cellular nervule, the subcostal nervure and its branches together forming a figure of almost the exact shape of a tuning-fork; *disco-cellular nervules* outwardly oblique, the *upper* concave, the *lower* shorter than the upper; the *discoidal* nervule curved, and, like the disco-cellular nervules, very fine but perfectly distinct; *second median* nervule given off some little distance before the lower end of the discoidal cell, more than twice as far from the base of the first as it is from the base of the third median, all three median nervules, however, arising near to the lower end of the cell; *submedian* and *internal nervures* straight. *Antennæ* exactly half the length of the costa of the forewing, with a well-formed club, the tip slightly hooked; *thorax* rather slender, *abdomen* very slender. FEMALE differs from the male in having the wings broader and more rounded, and lacks in the type species the patch of androconia on the upperside of the forewing. Type, "*Thanaos*" *stigmata*, Moore.

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* Proc. Zool. Soc. Lond., 1878, p. 844.

The type of the genus *Thanaos* of Boisduval (1832-33), in which all the species of *Aëromachus* have hitherto been placed, is the "*Papilio*" *tages* of Linnæus, which occurs in Europe and Western Asia (Amurland, &c). *Thanaos* is usually ranked as a synonym of *Nisoniades*, Hübner (1816), of which the type is *bromius*, Stoll, a South American species, which is probably not congeneric with *tages*. *Aëromachus* differs from *T. tages* in the shape of the wings, especially in the hindwing, which in that species is altogether much larger, and has the costa almost straight and very much longer, thus giving quite a different outline to the wing; the forewing of the male of

T. tages has the costa folded over on the upperside; the differences in neuration too are considerable, in the forewing of *T. tages* the first median nervule arises near the base of the wing, in *Aëromachus* near the lower end of the cell; and the shape of the discoidal cell of the hindwing is quite different, in *T. tages* being square-ended, the disco-cellulars being perfectly upright, and of equal length.

The genus *Aëromachus* is, as far as I know, strictly confined to India, where it occurs all along the Himalayas, in Assam, Burma, and again in the hills of South India. They rest with wings closed over the back.

(1.) AËROMACHUS STIGMATA, Moore.

Thanaos stigmata, Moore, Proc. Zool. Soc. Lond., 1878, p. 694; idem, id., l. c., 1882, p. 262; id., de Nicéville, Journ. A. S. B., vol. li, pt. 2, p. 66, n. 203 (1882); idem, id., l. c., vol. liv, pt. 2, p. 122, pl. ii, fig. 2, *male* (1885); id., Doherty, Journ. A. S. B., vol. lv, pt. 2, p. 139, n. 267 (1886); id., Elwes, Trans. Ent. Soc. Lond., 1888, p. 452, n. 484.

HABITAT: Masuri, N.-W. Himalayas (*Moore*); Bágheswar, Balwakot, 2-4,000 feet, Kumaon (*Doherty*); Sikkim (*de Nicéville* and *Elwes*); Simla; Kotgarh; Kulu Valley; Bhutan; Khasi Hills.

(2.) AËROMACHUS INDISTINCTA, Moore.

Thanaos indistincta, Moore, Proc. Zool. Soc. Lond., 1878, p. 694; idem, id., Journ. Linn. Soc. Lond., Zoology, vol. XXI, p. 53 (1886); id., Hampson, Journ. A. S. B., vol. lvii, pt. 2, p. 366, n. 246 (1888).

HABITAT: Salween, Moulmain, Mergui—all in Burma (*Moore*); Nilgiri Hills, 3,000 feet (*Hampson*); Pulni Hills.

(3.) AËROMACHUS OBSOLETA, Moore.

Thanaos obsoleta, Moore, Proc. Zool. Soc. Lond., 1878, p. 694; *T. ? obsoleta*, Wood-Mason and de Nicéville, Journ. A. S. B., vol. lv, pt. 2, p. 389, n. 235 (1886).

HABITAT: Cherra Punji, Assam (*Moore*); ? Silcuri and Subong, both in Cachar (*Wood-Mason* and *de Nicéville*).

(4.) AËROMACHUS JHORA, de Nicéville.

Thanaos jhora, de Nicéville, Journ. A. S. B., vol. liv, pt. 2, p. 4, n. 313; p. 122, pl. ii, fig. 12, *male* (1885); id., Elwes, Trans. Ent. Soc. Lond., 1888, p. 453, n. 486.

HABITAT: Sikkim (*de Nicéville* and *Elwes*); ? Shillong, Khasi Hills (*Elwes*).

(5.) Aëromachus kali, de Nicéville.

Thanaos kali, de Nicéville, Journ. A. S. B., vol. liv, pt. 2, p. 4, n. 312; p. 123, pl. ii, fig. 3, *male* (1885); id., Elwes, Trans. Ent. Soc. Lond., 1888, p. 453, n. 485.

Habitat: Sikkim (*de Nicéville* and *Elwes*).

Note.—Mr. H. J. Elwes suggests that the "*Pyrgus*" *inachus* of Ménétriés from the Amur, Shanghai, and Japan, belongs to this genus, and may indeed be conspecific with *A. jhora*.

Genus ODONTOPTILUM, nov.

Forewing, elongated; *costa* gently arched; *apex* acute; *outer margin* at first at right angles to the costa, then directed strongly obliquely inwardly; *inner angle* rather acute, *inner margin* short, sinuous, of about the same length as the outer margin; *costal nervure* not reaching to opposite the apex of the discoidal cell; all four *subcostal nervules* with their bases about equally distant one from the other; the *fourth* subcostal reaching the apex of the wing; the terminal portion of the *subcostal nervure* ending on the outer margin considerably below the apex of the wing; *upper disco-cellular nervule* stout, straight, short, outwardly oblique; *middle* disco-cellular shorter than lower; *lower* disco-cellular straight, in the same straight line as the middle, both strongly inwardly oblique; *median* nervules arising very far apart, *second* median arising long before the lower end of the cell; *first* median arising one-third of the length of the cell from the base of the wing; *submedian nervure* sinuous; *internal* nervure short and running into the submedian nervure, both as usual. Hindwing, *costa* short, much produced at base, then straight to apex; *outer margin* strongly excavated between terminal points of costal nervure and first subcostal nervule, then arched to anal angle; *anal angle* slightly produced lobe-wise; *inner margin* sinuous; *costal nervure* gently arched, ending at apex of wing; *first subcostal nervule* arising some distance before the apex of the discoidal cell; *upper disco-cellular* nerveus straight, slightly outwardly oblique, in the same straight line as the lower; *lower* disco-cellular longer than the upper; *discoidal* nervule fine but quite distinct; *second median* nervule given off just before the lower end of the cell; *first* median given off slightly nearer to the lower end of the cell than to the base of the wing; *submedian* and *internal nervures* straight. *Antennæ* less than half as long as the costa of the forewing, with a well-formed club and hooked tip; *thorax* stout, *abdomen* rather stout, not nearly as long as the abdominal margin of the hindwing. Sexes alike, *male* with no secondary sexual characters on the wings, but the fore legs are furnished with a very thick tuft of hairs attached to the anterior end of the coxa, the hairs being slightly longer than that joint. Type, "*Achlyodes*" *sura*, Moore.

Mr. Moore placed the type species of *Odontoptilum* in the genus *Achlyodes*, Hübner (1816), of which the type is the South American *fredericus*, Hübner, with which *O. sura* will probably be found to have but slight connection. Mr. Distant placed *O. sura* in the genus *Abaratha*, Moore (1881), of which the *Pterygospidea ransonnetii* of Felder is the type. In that genus the fore legs of the males are furnished with a tuft of long setæ* which are also found in *O. sura*, but are very much shorter and much more dense in the latter. The type species of *Abaratha* and *Odontoptilum* differ also in the shape of the discoidal cell of both wings; in the former in the forewing the middle disco-cellular nervule is upright, and therefore forms an obtuse angle with the inwardly oblique lower disco-cellular; in the latter the two veins are in one straight line; in the hindwing of the former the lower disco-cellular is quite upright, thus forming an angle with the upper outwardly oblique disco-cellular, in the latter both are in one straight line and are outwardly oblique. Otherwise there does not appear to be much difference between the two genera either in neuration or outline of the wings. Mr. Kirby places *O. sura* in the genus *Antigonus* of Hübner (1816), of which the *nearchus* of Latrielle from South America is the type. It is very improbable that this species either is congeneric with *sura*.

The genus *Odontoptilum* occurs all along the outer ranges of the Himalayas, in South India, in Assam, Burma, the Malay Peninsula, Sumatra, Borneo, Celebes, the Philippine Isles, and China. They rest with wide outspread wings.

(1.) ODONTOPTILUM SURA, Moore.

Achlyodes ? sura, Moore, Horsfield and Moore, Cat. Lep. Mus. E. I. C., vol. i, p. 251, n. 569 (1857); *Achlyodes sura*, Moore, Proc. Zool. Soc. Lond., 1865, p. 786; *Antigonus sura*, id., Journ. Linn. Soc. Lond., Zoology, vol. xxi, p. 53 (1886); id., Elwes and de Nicéville, Journ. A. S. B., vol. lv, pt. 2, p. 441, n. 165 (1886); id.,

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* *Vide* Journ. Bomb. Nat Hist. Soc., vol. iv, p. 175 (1889).

Elwes, Trans. Ent. Soc. Lond., 1888, p. 458, n 511; *Abaratha sura*, Wood-Mason and de Nicéville, Journ. A. S. B., vol. lv, pt. 2, p. 391, n. 248 (1886); id., Distant, Rhop. Malay., p. 390, n. 1, pl. xxxiv, fig. 16, *male* (1886); *Antigonus angulata*, Moore (*nec* Felder), Proc. Zool. Soc. Lond., 1882, p. 263; id., de Nicéville Journ. A S. B., vol. lii, pt. 2, n. 100, n. 283 (1883); id., Hampson, Journ. A. S. B., vol. lvii, pt. 2, p. 368, n. 273 (1888); *Pterygospidea helias*, Felder, Reise Novara, Lep., vol. iii, p. 529, n. 936, pl. lxxiii, figs. 12, 13, *male* (1867); *Tagiades helias*, Plötz, Jahr. des Nass. Ver., vol. xxxvii, p. 42, n. 6 (1884).

HABITAT: Darjeeling; N.-E. Bengal; Thaing, King Island, Mergui Archipelago; N.-W. Himalayas (*Moore*); Sikkim (*Elwes* and *de Nicéville*); Cachar (*Wood-Mason* and *de Nicéville*); Perak; Malacca (*Distant*); Nilgiri Hills, S. India, 2,000—4,000 feet (*Hampson*); Tavoy and Ponsekai (*Elwes* and *de Nicéville*); Celebes (*Felder* and *Plötz*); Assam; Wynaad.

Note.—To judge from Felder's figure of *O. helias*, from Celebes, it appears to me highly probable that it represents a species distinct from *O. sura*.

(2.) ODONTOPTILUM ANGULATA, Felder.

Pterygospidea angulata, Felder, Verh. zool.-bot. Gesellsch. Wien, vol. xii, p. 488, n. 149 (1862); idem, id., Reise Novara, Lep., vol. iii, p. 529, n. 935, pl. lxxiii, figs. 10, 11, *male* (1867); *Tagiades angulata* (part), Plötz, Jahr. des Nass. Ver., vol. xxxvii, p. 41, n. 5 (1884).

HABITAT: Hongkong, South China; Luzon (*Felder*); India [?]; Sumatra [?] (*Plötz*).

(3.) ODONTOPTILUM PYGELA, Hewitson.

Pterygospidea pygela, Hewitson, Desc. Hesperidæ, p. 53, n. 6 (1868); idem, id., Ex. Butt., vol. v, *Pterygospidea* pl. i, fig. 3 (1873); *Antigonus pygela*, Druce, Proc. Zool. Soc. Lond., 1873, p. 360, n. 1; *Abaratha pygela*, Distant, Rhop. Malay., p. 390, n. 2, pl. xxxiv, fig. 18 (1886); *Tagiades pygela*, Plötz, Jahr. des Nass. Ver., vol. xxxvii, p. 42, n. 7 (1884).

HABITAT: Borneo and Malacca (*Hewitson*); Borneo (*Druce*); Perak (*Distant*); Borneo; Malacca (*Plötz*); Jelebu.

Note.—The outline of the hindwing of *O. pygela* differs considerably from that of *O. sura*, as in the former the outer margin is very deeply excavated between the terminal points of the second subcostal and third median nervules, which is very slightly if at all the case in *O. sura*.

Genus CTENOPTILUM, nov.

Forewing, narrow, elongated; *costa* arched at base, then straight to apex; *apex* acute; *outer margin* at right angles to costa from apex to termination of third median nervule, this portion also being slightly excavated, from third median nervule to inner angle strongly inwardly oblique, also slightly concave; *inner angle* rather acute; *inner margin* sinuous; *costal nervure* very short, not nearly reaching opposite to the apex of the discoidal cell,; *first*, *second*, and *third subcostal nervules* also very short, rapidly reaching the costa, *fourth* subcostal long, extending to apex of wing, the bases of all the subcostals nearly equi-distant; terminal portion of *subcostal nervure* reaching outer margin below apex of wing; *discoidal cell* long, narrow, reaching to more than half though less than two-thirds the length of the wing; *upper disco-cellular nervule* short, straight, outwardly oblique; *middle* and *lower* disco-cellulars straight, slightly inwardly oblique, the lower a little longer than the middle; *second median* nervule arising considerably before the lower end of the cell; first median arising much nearer to the base of the wing than to the lower end of the cell; *submedian nervure* sinuous, following the outline of the inner margin; *internal* nervure short, running into the submedian nervure as usual. Hindwing, with the base of the *costa* much produced, thence gently curving to apex; *outer margin* slightly produced toothlike at apex of first subcostal nervule, very strongly at third median nervule, thence inwardly oblique to anal angle and slightly concave; *anal angle* rounded; *inner margin* nearly straight; *costal nervure* curved, reaching the apex of the wing; *first subcostal nervule* originating long before the apex of the discoidal cell; *disco-cellular* nervules of equal length, almost straight, slightly outwardly oblique; *discoidal* nervule fine but quite distinct; *second median* nervule given off close to the lower end of the cell; *first* median arising nearer to lower end of the cell than to the base of the wing; *submedian* and *internal nervures* almost straight. *Antennæ* about half as long as the costa of the forewing, with a well-formed club; *thorax* rather stout; *abdomen* rather slender, not quite reaching to anal angle of hindwing. Male with no secondary sexual characters on the wings, but with a dense tuft of hairs attached to the anterior end of the tibia of the hind legs, the hairs extending to the apex of the first joint of the tarsus. FEMALE like the male, except that the wings are rather larger and broader. Type, the *"Achlyodes" vasava* of Moore.

Ctenoptilum is evidently nearest allied to *Odontoptilum*, mihi, but differs considerably in the outline of the wings, in the shortness of the costal nervure and subcostal nervules of the forewing, and especially in the setose clothing of the legs of the male, in *Ctenoptilum* the hairs are much longer and do not form such a large and dense mass as in *Odontoptilum*, and are attached to the tibia of the hindlegs instead of to the coxa of the forelegs.

As far as is known to me, the genus contains but two species, which occur in Sikkim, Assam, and Burma. They probably rest with wide outspread wings.

(1.) CTENOPTILUM VASAVA, Moore.

Achlyodes ? vasava, Moore, Horsfield and Moore, Cat. Lep. Mus. E. I. C., vol. i, p. 252, n. 570 (1857); *Achlyodes vasava*, Moore, Proc. Zool. Soc. Lond., 1865, p. 786; *Antigonus vasava*, Elwes, Trans. Ent. Soc. Lond., 1888, p. 458, n. 512.

HABITAT: Darjeeling (*Moore*); Sikkim (*Elwes*); Khasi Hills.

16. (2.) CTENOPTILUM MULTIGUTTATA, n. sp., Pl. E, Fig. 10, ♂.

HABITAT: Burma.

EXPANSE: ♂, ♀, 1·5 inches

DESCRIPTION: MALE. UPPERSIDE, *both wings* reddish-ochreous, with numerous lustrous semi-transparent white spots. *Forewing* with a small spot in the discoidal cell towards the base, with an elongated spot below it in the submedian interspace, sometimes divided into two; a very large spot at the end of the discoidal cell, outwardly anteriorly deeply incised; two spots above it just below the costa divided by the first subcostal nervule; a discal curved series of ten spots, of which the first four are of nearly equal size (the uppermost the smallest), divided by the subcostal nervules, followed by a rapidly increasing series of four spots, one in each interspace; then by two spots, the lower three times as large as the upper, in the submedian interspace; a submarginal obscure fuscous band. *Hindwing* with a clump of spots shewing great diversity in shape and size occupying the middle of the wing; a submarginal dark fascia as in the forewing. UNDERSIDE, *both wings* coloured and marked as above, but all except the outer margin thickly frosted with grey, which appearance is found on examination under a strong lens to be due to the presence of long white hair-like scales scattered somewhat sparsely over the surface. FEMALE differs from the male only in being rather paler, and the submarginal dark fascia above more prominent.

Near to the "*Achlyodes*" *vasava* of Moore*, from Sikkim and Assam, from which it differs in its more reddish less ochreous ground-colour, considerably less angulated wings, the forewing on the upperside on the disc and base not suffused with black, the third spot of the discal series equal in length to the spot on either side of it, instead of, as in *C. vasava*, being greatly lengthened out and ending in a point just below the costa; and all the spots on the hindwing smaller, especially those in the discoidal cell, the middle spot of *C. vasava* being divided into two in *C. multiguttata*.

Described from two male specimens from the Meplay Valley, taken in February, another from the Donat Range, taken in January, and a female from the valley of the Houngdarou taken in March, all in Upper Burma, by Majors C. T. Bingham and C. H. E. Adamson. This is probably one of the species referred to by Mr. H. J. Elwes as from Akyab and Tenasserim in Trans. Ent. Soc. Lond., 1888, p. 458, n. 512.

17. CELÆNORRHINUS CONSERTUS, n. sp., Pl. E, Fig. 12, ♂.

HABITAT: Khasi Hills.

EXPANSE: ♂, 1·7; ♀, 1·8 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* dark rich brown approaching to fuscous, the base of the forewing and the entire hindwing sprinkled with long ochreous-ferruginous hair-like scales. *Forewing* with three conjoined subapical lustrous white dots, the posterior rather nearer to the outer margin of the wing than the others; a compact discal lustrous white patch, anteriorly bounded by the subcostal nervure, posteriorly by the first median nervule, its inner edge nearly straight and even, its outer edge irregular owing to that portion of the patch situated at the base of the second median interspace being projected slightly forwards and beyond the line of the outer edge of the patch. *Hindwing* with a large rounded discoidal spot, with a similar discal series beyond formed by portions of the ground-colour being free from the ochreous-ferruginous hair-like scales. *Cilia* concolorous with the wings throughout. UNDERSIDE, *forewing* entirely dark brown; the lustrous white spots as above, but the discal one with two pale yellow dots divided by the first subcostal nervule placed anteriorly against it; a subanal pale yellow patch divided into two by the submedian fold. *Hindwing* much as on the upperside. *Antennæ* black, with the shaft just below the club on the underside and the tip of the club beneath ochreous. FEMALE. UPPERSIDE, *both wings* exactly as in the male, but the long hair-like scales less numerous. UNDERSIDE, *both wings* as in the male.

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* Proc. Zool. Soc. Lond., 1865, p. 786.

Very probably near to "*Plesioneura*" *asmara*, Butler, from Malacca and Java, of which no sufficient description exists, but which Distant states is "closely allied to *P. alysos*," Moore, a species of the genus *Notocrypta*, in which I have provisionally placed "*P.*" *asmara*.

C. consertus has been described from two pairs obtained by the Revd. Walter A. Hamilton in the Khasi Hills.

18. CELÆNORRHINUS CACUS, n. sp., Pl. E, Fig. 11, ♂.

HABITAT: Rangoon.

EXPANSE: ♂, 1·6 inches.

DESCRIPTION: MALE. Very near to *C. consertus*, mihi, but differing in the following particulars:—Smaller, wings narrower. UPPERSIDE, *both wings* much more thickly clothed with long ochreous hair-like scales than in that species, giving the ground a much more yellow appearance. *Forewing* with two subapical dots only, the lower most minute. UNDERSIDE, *both wings* present the same differences as on the upperside.

Described from a single example taken at Rangoon in January, and deposited in the Phayre Museum.

19. PARNARA WATSONII, n. sp.

HABITAT: Upper Burma.

EXPANSE: ♂, ♀, 1·9 to 2·0 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich dark glossy vinaceous-brown. *Forewing* with three subapical rather large conjugated dots; three increasing discal spots placed obliquely, the second about twice as large as the first, the third about three times as large as the second, the two lower spots with their inner ends convex, their outer concave; all these spots diaphanous lustrous white; a somewhat elongated opaque yellowish spot in the submedian interspace placed against the middle of the submedian nervure; the base of the wing clothed with long dull ochreous hair-like scales. *Cilia* of a slightly lighter shade of colour than the ground. *Hindwing* with the base and abdominal margin thickly clothed with long dull ochreous setæ, the disc with a faint whitish discal macular band. *Cilia* whitish. UNDERSIDE, *forewing* fuscous, the costa and apex widely ochreous-ferruginous; the diaphanous spots as above; a broad submarginal whitish patch just anterior to the middle of the outer margin of the wing. *Hindwing* ochreous-ferruginous bearing a large triangular patch of white, which occupies all the surface except the costa and the outer margin widely, and a tripartite patch of the ground-colour divided by the median nervules in its middle; all the veins that reach the outer margin white. *Head, thorax* and *abdomen* fuscous above, white beneath, the latter striped with white at the sides. *Antennæ* black throughout. FEMALE almost as in the male, but in two specimens out of three in the *forewing*, there is a fourth smaller discal spot in the lower discoidal interspace, and still another in the submedian interspace almost touching the first median nervule and very small. *Hindwing* with the discal macular white patch more prominent than in the male.

Nearly allied to the "*Hesperia*" *semamora* of Moore,* originally described from Bengal, but occurring in Sikkim, Assam and Burma, from which it differs in all the diaphanous spots of the forewing being larger, the opaque spot in the submedian interspace always present (in *P. semamora* it is found in the females only, and is very small), and notably in the large pure white anal patch of *P. semamora* being replaced by a whitish shade only in the males, rather more prominent in the females in *P. watsonii.* On the underside of the hindwing there is always a large patch of the ochreous-ferruginous ground-colour in the middle of the white area, this is only occasionally present in *P. semamora*, and is when present very small.

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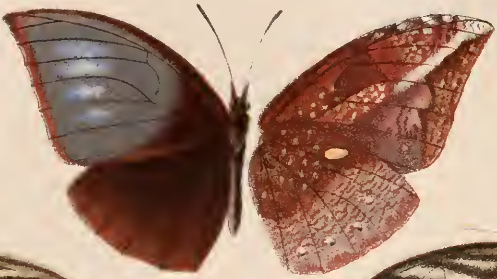
* Proc. Zool. Soc. Lond., 1865, p. 791.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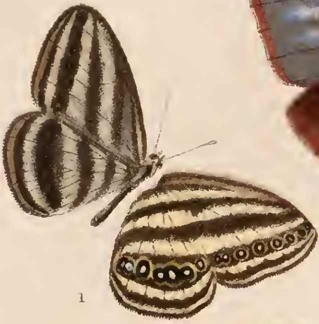
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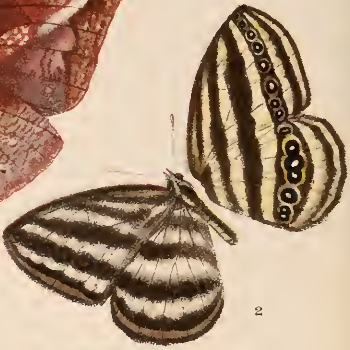
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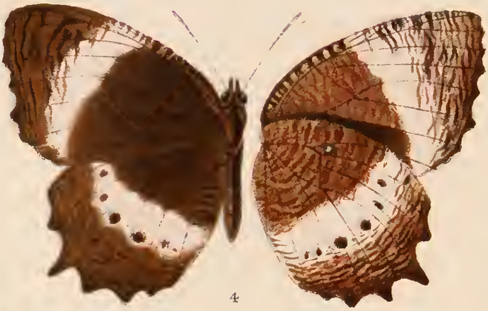
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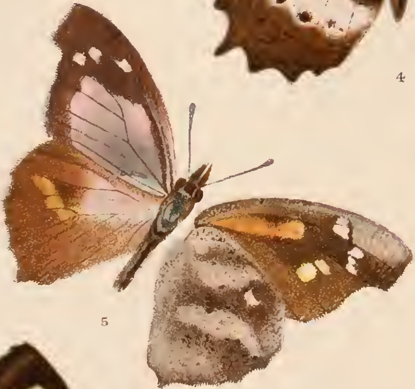
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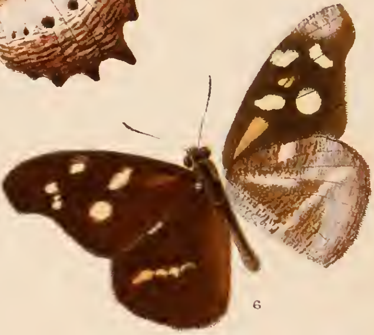
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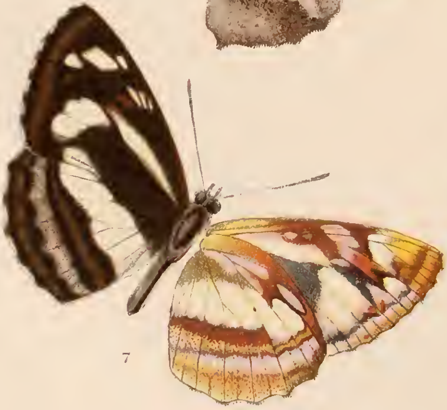
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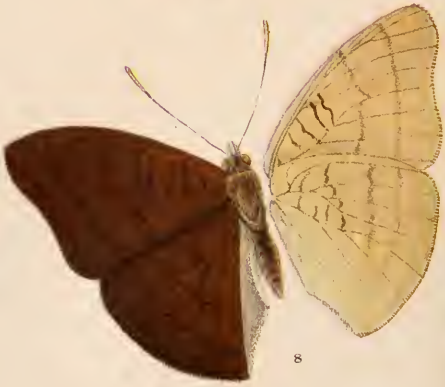
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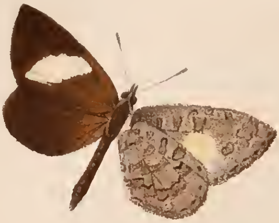
INDIAN BUTTERFLIES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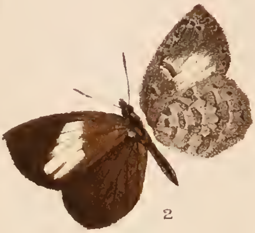
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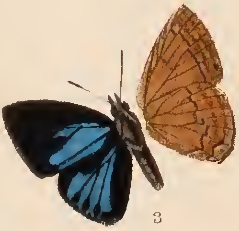
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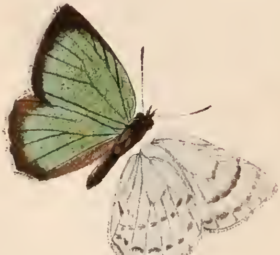
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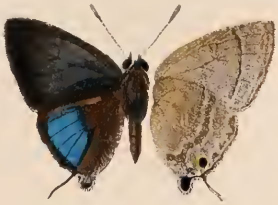
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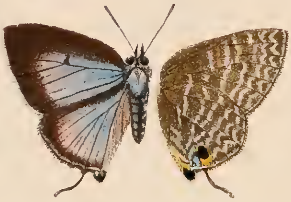
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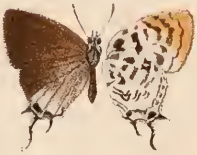
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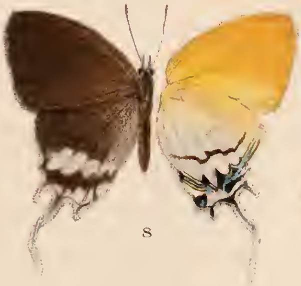
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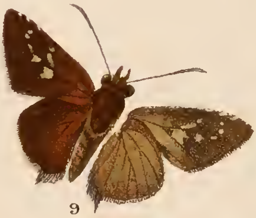
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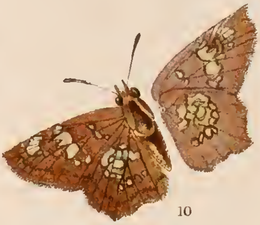
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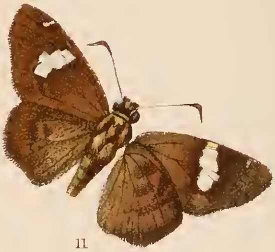
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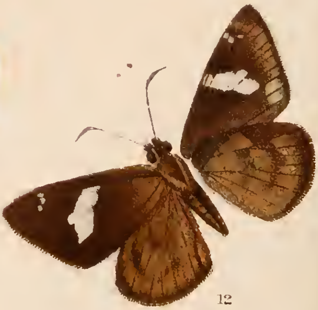
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INDIAN BUTTERFLIES

The markings of *P. semamora* are by no means constant, but the species can always be instantly distinguished from *P. watsonii* by the large pure white area on the upperside of the hindwing. In Burma both sexes of the two species have been found flying together, so one cannot be a seasonal form or geographical race of the other.

Described from seven males and three females collected at Tilin Yaw, Upper Burma, in March, 1890, by Lieutenant E. Y. Watson, after whom I have much pleasure in naming it.

EXPLANATION OF THE PLATES.

Plate D.

Fig. 1. *Ragadia crito*, n. sp., ♂, p. 199.
,, 2. ,, ,, ,, ♀ ,, ,,
,, 3. *Elymnias chelensis*, n. sp., ♂, p. 200.
,, 4. *Dyctis dædalion*, ,, ♀, p. 202.
,, 5. *Libythea geoffroyi*, Godart, ♂, p. 205.
,, 6. ,, *libera*, n. sp., ♂, p. 207.
,, 7. *Neptis nycteus*, n. sp., ♂, p. 203.
,, 8. *Euthalia elicius*, n. sp., ♂, p. 205.

Plate E.

Fig. 1. *Gerydus gopara*, de Nicéville, ♂, p. 208.
,, 2. ,, ,, ,, ♀ ,, ,,
,, 3. *Zarona pharygoides*, n. sp., ♂, p. 208.
,, 4. *Zephyrus khasia*, de Nicéville, ♂, p. 210.
,, 5. *Rapala scintilla*, ,, ♂, p. 212.
,, 6. ,, *deliochus*, Hewitson, ♀, p. 212.
,, 7. *Biduanda scæva*, Hewitson, ♀, p. 210.
,, 8. ,, *cinesoides*, de Nicéville, ♀, p. 211.
,, 9. *Isoteinon iapis*, n. sp., ♂, p. 213.
,, 10. *Ctenoptilum multiguttata*, n. sp., ♂, p. 221.
,, 11. *Celænorrhinus cacus*, n. sp., ♂, p. 223.
,, 12 ,, *consertus* ,, ♂, p. 222.

BOMBAY GRASSES.

By Dr. J. C. Lisboa, F.L.S.

Part II.

(*Continued from Vol. V., p.* 131.)

(*Read at the Society's Meeting on 23rd September* 1890.)

P. jumentorum, Pers.; *P. maximum*, Jacq. t. 13; *P. altissimum*, D. C.; Dalz. and Gibs. *Bomb. Fl.* Suppl. 98.

This is the well-known "Guinea-grass." Though grown to a large extent in the West Indies, it does not, according to the authors of the "Bombay Flora," "fare well in India on account of the dry climate, unless grown in shady places and well irrigated." This was written in 1861. Since then, carefully-conducted experiments have been made in various parts of India as well as in Ceylon. I take the following from a letter written to me some time ago by Mr. Woodrow, Professor of Agriculture and Botany in the Poona College of Science. He says: "*Panicum jumentorum* is cultivated by "so-called advanced cultivators throughout India. I have generally "about two acres of it. At Madras I have seen ten acres, and am told "that near Ahmedabad there are about 100 acres. On a sandy "soil with irrigation it is found to be a profitable crop for forage to "be cut green."

The following statement was furnished me by the Director of Land Records and Agriculture*:—

"It has been grown on the Hyderabad Farm (Sind) since 1886-87, "and has now almost passed the experimental stage. At present "its cultivation is not very remunerative, but as time goes on, and "the popular prejudice against its use wears out, it is hoped that it "will, like lucerne, be one of the principal paying crops in the "Farm.

"It is a perennial grass, and, when first planted, it frequently "attains a height of 9 feet and sometimes even of 10 feet and above; "but when cut two or three times it does not grow so high but

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* My best thanks are due to the Acting Director of Agriculture, Mr. Bhimbhai Kirparam, for the ready assistance and valuable information which has been promptly placed at my disposal by this active and intelligent Government officer.

" grows thicker, its tussacks varying from 6 inches to a foot in " diameter. It penetrates deep into the soil, and on account of its " long roots, it is more able to resist drought than many of the " fodders cultivated. It is well suited for the edges of water " channels as the roots spread and protect the earth from being " washed away.

" The following statement gives the results for the last three " years:—

Area.	Year.	Outturn per acre.	Value of produce per acre.	Cost of cultivation per acre.	REMARKS.
A. G.		lbs.	Rs.	Rs.	
0·20	1886-87	16,748	128	159	Soil, stiff clay, hard to work. Sown on 13th March. Top dressed (1) 18th August 1 ton of poudrette; (2) 8th September, ton of poudrette; (3) 9 cwts. goat manure. Once weeded and 21 times manured.
Same.	1887-88	16,498	116	77	Last year's crop; twice top dressed; 18th May 2¾ tons of cow manure; 25th August 4½ tons cowdung; twice ploughed between rows; 45 times watered.
Do.	1888-89	10,136	67	54	Third year's crop once weeded and 19 times watered.
2·13	1887-88	13,071	101	143	Mostly light sandy soil. Sown in April. Manured with 10½ tons of cowdung and 1¼ tons of goat manure per acre. Once top dressed with 8 tons of cow manure and 2½ tons of goat manure per acre. 4 times weeded and 15 times watered.
Same.	1888-89	12,602	86	105	Second year's crop. Twice weeded and once ploughed. Once top dressed with 10 tons 76 lb. of cow manure; 19 times watered.

" In the first year it does not pay: and this is mainly due to the " first cost of preparing and planting the field."

As the subject of the cultivation of this exotic grass is one of considerable interest, I have embodied in this paper the results of experiments made elsewhere in the hope of their proving of some benefit to the cultivator and others.

Mr. Simmons in his brochure on *Indian Grasses* gives the following history of the experiments made in Saidapet (Madras) :—

" *Guinea Grass*—Has, of all the grasses experimented with, been " found to be the best; it is an exotic, but perfectly acclimatized, grass, " which is most easily propagated by root-cuttings. Its culture is " very simple, for if planted at the commencement of the rains, it " soon strikes root, and is then safe and out of danger for the future. " If planted in rows it allows of interculture by cattle power, by " which means the land on which it grows may be easily cleansed; " thus it affords an excellent crop for a rotation. It has been found " capable of withstanding our longest and severest droughts without " the aid of irrigation, and although its energies remain dormant " during such a time, the first rain makes it spring up again most " rapidly. This power was never more clear than in a field " planted in September 1875, measuring about two acres, which, in " May 1877, after the great drought, was as brown and as dry as if it " were totally devoid of life; the heavy rains which fell during that " month, however, led to its immediate revival, and before the third " day of rain was over, green shoots had appeared all over the field " which grew on and produced a good crop of fodder in two months, " which weighed green 5,556 lbs.; this was followed by another " cutting of 4,564 lbs. of dry fodder; two months after, an amount " equal to about 12,000 lbs., green. Not one per cent. of the tufts " failed to throw out shoots after the rain referred to.

" An idea still prevails that Guinea grass must be irrigated not " only at the time planted, but regularly at stated intervals after- " wards; that it must be taken up and be replanted on new ground " at the end of every two years at the furthest; and that the fodder is " not a suitable food for stock, and can only be used in small quan- " tities for such a purpose. It is perfectly true that if Guinea grass " is planted in the hot season, or during dry weather, when the soil " contains scarcely a particle of moisture, and the sky is clear and " bright, that the plants will fail completely if not planting under " such circumstances. In the dryest parts of the country there is " always a time when the sky is cloudy and the weather showery; " and if such opportunities are properly utilized for planting, the " roots can be established well without the aid of irrigation. Irriga-

" tion, of course, enables more cuttings to be obtained in the year, " but it is never necessary for the maintenance of the crop. It is, " however, most necessary to manure land well for Guinea grass. " It is general on the farm to plant this grass (the sets being " obtained by dividing into several parts old tussacks from another " field) on the ridge on a showery day, care being taken that they " are planted uniformly at a distance of 2 feet apart in each direction, " thus admitting the use of the plough between the lines of plants " and across these lines at right angles; for it is advisable to pass a " plough or cultivator occasionally through and across the crop as " the absorbtive powers of the soil can, in this way, be kept up. " This ploughing or cultivating should be repeated at any rate once " after the removal of each cutting.

" Before the end of the second year the plants from frequent " cutting will have formed large tussacks; these would be reduced " by simple chopping with a spade, hoe, or man-vitti. It has been " found best to make two cuts across the tussacks at right angles " to each other, thus dividing it into four parts. Of these, three may " be removed and form excellent bedding for cattle stalls, the fourth " remaining to perpetuate the crop. In this way there is no necessity to remove the plants to other ground, but care must be exercised to see that the soil is properly manured, as a crop which " yields such large returns necessarily makes large demands on the " soil. The fodder can be used for all kinds of stock: at first it " seems to disturb the digestive organs of some animals, but this is " only temporary; cattle and sheep have been fed on it exclusively " for months not only without any ill effects, but with the most satisfactory results. A Guinea grass field is a capital place in which to " graze working cattle during the hot season, while for ewes with " young lambs better pasture could scarcely be discovered. It produces an abundant flow of milk in the ewes, without, what is " common in such cases, disturbing the health of either mother or " lambs; care must, however, be always observed never to graze " Guinea grass too closely."

Equally successful experiments have been made in Ceylon. Here is what Mr. Fergusson says in his Catalogue of Ceylon Grasses:—

" It is the Rata (foreign) Tana of the Sinhalese. When and by

" whom it was introduced to Ceylon I find no record, though it is " probable there may be one in the Royal Gardens at Peradeniya. " It was grown in Ceylon in Moon's time, 1824, at any rate. The " late Dr. Gardner introduced what he supposed to be a new fodder " grass to Ceylon, but in 1843 or 1844, he gave a full description of " it in the *Ceylon Observer*, proving that it was identical with Guinea " grass. It was introduced to Jamaica about 1744 from the Coast " of Guinea. The following is an extract from Lunan's Hortus " Jamaicensis:—

" 'This most valuable grass is a native of Africa, and was intro-" duced into the island many years ago by the merest accident. Mr. " John Ellis got some birds from the Coast of Guinea, and with " them some seeds for their support; the birds dying soon after, the " seeds were thrown out of doors as useless. From these seeds grew " some luxuriant grass, which attracted Mr. Ellis's notice, and he " had a horse and a cow brought where it was, when both of them " greedily eat of it. It was then transplanted into a garden and " gradually cultivated, until it has become one of the most lucrative " and useful plants in Jamaica. It agrees with almost every soil and " situation, and has rendered many rocky and otherwise barren spots " of Jamaica very valuable as affording support to herds of cattle and " horses. The growth of this grass is quick, for in wet weather, " and in a favourable situation, it may be cut once in a fortnight. " It resists dry weather for a considerable time, and even when " parched up, the slightest shower will revive it. It rises from five " to eight feet high. When of proper strength it is a very excellent " food for horses and cattle, which, when considerably lean and " reduced, will be restored to flesh and fatness in two or three " months by feeding upon it.'

"There can be no doubt that the Guinea grass, and what is most " erroneously called in Ceylon *Mauritius grass,* are the two most " valuable fodder plants growing in Ceylon. I have seen the Guinea " grass grow in what seems to be the pure white sand of the Cinna-" mon Gardens near Colombo to a height of 6 to 8 feet, and if well " manured and kept free of weeds, it will, in rainy weather, give a " very fair crop monthly. It grows freely up to an elevation of " 5,000 to 6,000 feet on the Coffee Estates, but though a valuable "fodder grass at these elevations, it does not grow to such a height "as it does at lower elevations. It is extensively planted along the "edges of foot and bridle-paths on Coffee Estates; but Mr. Morris "gave his opinion against this practice, as the grass is supposed to "harbour the mycelium of the Coffee leaf fungus."

Duthie, at p. 9 of the "Fodder Grasses of Northern India," states that "this is the 'Guinea Grass,' a native of Tropical "Africa, and now extensively cultivated in most tropical countries. "Although it seeds freely in this country, it is nevertheless found "preferable to propagate it by root cuttings. In the *United States* "it is usually planted in this way, as it rarely matures seed in that "country. Manuring is beneficial where frosts prevail. Analysis "shows it to be very rich in nutritive qualities, and as it appears to "thrive well in the plains of Northern India, its extended cultivation should be encouraged."

P. miliaceum. Linn.; *P. asperrimum.* Lagasc; *P. pilosum,* Swartz.; *Fl. Ind., Occ.,* 141; Dalz. and Gib. *Bomb. Fl.* Suppl. 98; Church's *Food Grains of Ind.,* fig. 2.

Vern. *Varagu, Wuree Sawa, Badlee.*

There are several varieties cultivated in Guzerat and over the Ghats, named *Danglee, Rale,* &c. Duthie gives the following vernacular names, *Chena, Chinera, Worga.* (Roxb.)

This grass is a native of Egypt and Arabia cultivated in different parts of India on account of its grain which is considered nutritious by the natives and used by them as a kind of food at marriage ceremonies. The fodder obtainable from it is of very superior quality, but it is seldom made use of.

P. miliare, Lam. Ill 173; Roxb. *Fl. Ind.* 1-311.

Vern. *Poi, Nella-Shama* (Roxb.), *Kulti, Bagad, Badi, Burburi,* (Duthie.)

It is cultivated in Guzerat and other parts of this presidency, and is not uncommon on the Himalayas at moderate altitudes. The poorer classes of natives use the grain as an article of diet. The straw is readily eaten by cattle.

P. psilopodium, Trinn. Diss. II., 217.

This grass is named *Mordanura* in Khardi, Thana, where it is said to be rare. It is probably a wild species of the last-named panicum, and does not appear to be used at all.

P. frumentaceum. Roxb. *Fl. Ind.*, I., 137 ; *Oplismenus frumentaceus* Kunt. Enum, I., 146 ; Dalz. and Gib. *Bom. Fl.* Suppl. 98.

Vern. *Shamoola, Shama* (Roxb.), *Samuka, Sawak* (Duthie.)

Cultivated principally in Northern India as a rain crop. It is of very rapid growth, and ripens in about six weeks from the time of sowing. The grain which is of poor quality is used by the natives in preference to all others for religious purposes. The stalks are used as cattle fodder.

OPLISMENUS, *Beauv.*

O. Burmanni, Beauv. Agrost. t. 54 ; Dalz. and Gib. *Bomb. Fl.* 291.

Vern. *Kadack*, Bel. *Yerwa.*

Common everywhere, especially under the shades of trees and on cultivated ground. In the West Indies it goes by the name of Pagister grass or Scotch grass.

The following allusion to it appears in Loudon's *Encyclopædia of Agriculture.*—" The island (Jamaica) abounds also with different kinds of grass of excellent quality, the artificial grass called "Scott's Grass (*Panicum hirtellum*, fig. 199, a. p. 195), grows spontaneously in most of the swamps and morasses of the West Indies, "and is so productive, that a single acre of it will maintain "five horses for a whole year." According to Duthie—" In Oudh it "is reported that cattle eat this grass with relish," and . . . that it "makes good hay."

In Bombay it is also considered a good fodder for cattle.

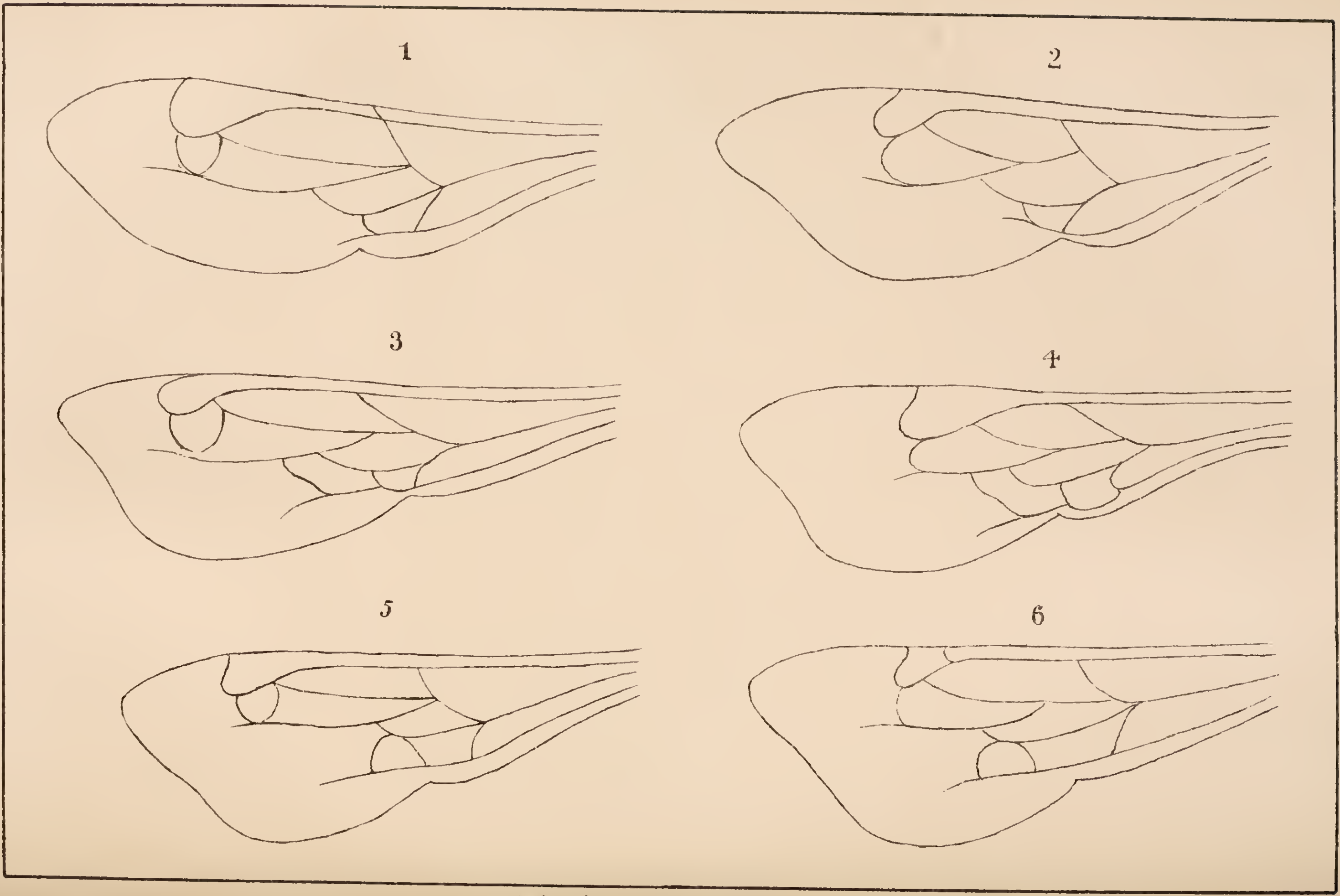
O. compositus, Beauv. Agrost. 54 ; *P. sylvaticus.* R. and S. ; *O. lanceolatus*, Kunt. Enum. 1, 146 ; Dalz. and Gib. *Bomb. Fl.* 292.

Vern. *Turdia, Shora.*

At Lanowli, Tanna, up to the foot of the ghauts, Roxburgh says cattle are not fond of it.

O. stagninus of Dalz. and Gib. *Bomb. Fl.* is the *Panicum crus-galli* of Linn.

The large form of this is cultivated in some parts as one of the millets or fine grains. Cattle are fond of this grass. (Ferguson).



Anterior wings (much enlarged) of

1. Triscolia. 2. Discolia. 3. Triclis. 4. Diclis. 5. Triliacos. 6. Diliacos.

I.—ON NEW AND LITTLE KNOWN HYMENOPTERA FROM INDIA, BURMA AND CEYLON.

By C. T. Bingham, F.Z.S., Forest Department, Burma.

[*Received, 3rd June 1890.*]

Tribe Fossores, *Latr.*

Family Scoliadæ, *Leach.*

The genera *Scolia* and *Elis* of Fabricius, and *Liacos* of Guerin, have been split up into the following sub-genera by de Saussure and Sichel in their "Catalogus Specierum Generis Scolia."

(*a*) *Triscolia*—Anterior wings with *three* cubital cells and *one* recurrent nervure.

(*b*) *Discolia*—Anterior wings with *two* cubital cells and *one* recurrent nervure.

(*c*) *Trielis*—Anterior wings with *three* cubital cells and *two* recurrent nervures.

(*d*) *Dielis*—Anterior wings with *two* cubital cells and *two* recurrent nervures.

(*e*) *Triliacos*—Anterior wings with *three* cubital cells, the third discoidal cell petiolated.

(*f*) *Diliacos*—Anterior wings with *two* cubital cells, the third discoidal cell petiolated.

In this family many of the species belonging really to different sub-genera bear so close a resemblance one to the other that a careful examination of their anterior wings is absolutely necessary for their discrimination.

1. Triscolia capitata, Guer.

Scolia capitata, Guer. Voy. Coq., p. 248, ♂; Burm. Mon. Scol., p. 20, 13; Smith. Cat. Hym. Ins. Brit. Mus., pt. iii., p. 114, 137; Sauss. & Sich., Cat. Spec. Gen. Scol., p. 47, 23; *Scolia ruficeps*, Smith. Cat. Hym. Ins. Brit. Mus., pt. iii., p. 111, 126.

Habitat: India, Philippines, Burma.

Female: Length 12 lines; expanse 18 lines.

Male: Length 7 lines; expanse 12 lines.

Description: ♀ Head brick red, the anterior margin of the clypeus, and tips of the mandibles black. Thorax and abdomen black, with in certain lights, and especially in freshly-captured specimens a purple gloss; wings dark fuscous with a golden bronze effulgence; legs black with black spines and hairs, those of the tibiæ and tarsi of the anterior pair tinged slightly with rufous. The whole head, thorax, and abdomen are closely punctured, the punctures on the head coarse and shallow; a space round the ocelli and the front between the antennæ are smooth and shining, and the occiput behind is fringed with a little rufous pubescence.

♂ Differs from the ♀ only in being smaller, and in having as in all Scoliadæ straight instead of cornute antennæ.

I have only procured this species in the Pegu hills, and in the vicinity of Moulmein in Tenasserim, where it is rare; Smith gives it from the Philippine Islands, and Guerin's type specimen is, according to Saussure, labelled "India orientali."

2. DISCOLIA MOLESTA, Sauss. and Sich.

Scolia (*Discolia*) *molesta*, Sauss. and Sich., Cat. Spec. Gen. Scol. pp. 111, 104.

HABITAT: Pulo, Penang, Singapore, Java, Borneo, Burma.

FEMALE: Length 11 lines; expanse 18 lines.

This insect so closely resembles *Triscolia capitata*, that for some time I confounded it with that species. The neuration of the anterior wings, however, shows that it belongs to a different subgenus. Other slight points of difference are, that in this species the mandibles and the *entire* clypeus are always, and a portion of the antennæ is sometimes, fuscous black: the wings, as a rule, also have far less of the brilliant coppery effulgence of *T. capitata*.

In Burma, *D. molesta* is a fairly common insect. In August and September I have found it frequenting the flowers of a thorny creeper (*Acacia pennata*).

3. DIELIS ANNULATA, Fabr.

Tiphia annulata, Fabr. Ent. Syst. ii., 225, 7, ♀; Syst. Piez. 234, 11.

Campsomeris servillii, St. Farg. iii., 501, 9, ♀ (nec. Guerin).

Scolia annulata, Smith. Cat. Hym. Ins. Brit. Mus. iii., p. 100, 72.

Elis (*Dielis*) *annulata*, Sauss. and Sich. Cat. Spec. Gen. Scol., 196, 210.

HABITAT: India, Burma, Java, China.

FEMALE (var.): Length 12½ lines; expanse 20 lines.

Description: ♀ Head black, smooth, or but slightly punctured; the clypeus, the front between the antennæ, the cheeks, and the occiput clothed with rather coarse orange yellow pubescence; the antennæ black cornute. Thorax black; the prothorax, the mesothorax anteriorly, the postscutellum and the metathorax above and on the sides covered densely with the same orange yellow pubescence; the disc of the mesothorax and the scutellum naked closely and coarsely punctured; the metathorax posteriorly truncate, slightly concave, smooth and shining; wings sub-hyaline, of a light yellowish brown, and brilliantly iridescent; a dark yellow stain spreads from the apex of the medial, through the 1st cubital, into the base of the radial cell; legs black with hoary bristles and hairs, the anterior tibiæ with three spines outwardly at their apex, their tarsi as well as the tibiæ and tarsi of the intermediate and posterior legs ciliated with strong black spines; the calcaria of the posterior pair of legs transparent white. Abdomen black and shining, sparsely but coarsely punctured, the segments 1—4 fringed posteriorly with hoary white hairs; this fringe is interrupted on the under surface of the 1st segment, and in the middle on the dorsal surface of the 4th, the pubescence here as well as that clothing the 5th and apical segments being black.

This very fine variety of one of the commonest of the *Scoliadæ* was kindly sent to me from Kumaon by Miss A. Brooke, and for some time I was under the impression that I had got hold of a new and undescribed species, as in a series of over a hundred specimens of *D. annulata,* though there was considerable variation among the individuals, none of the females wanted, as this specimen does, the conspicuous dark tippings to the anterior wings. In other points, however, this Kumaon specimen so closely resembles typical *D. annulata,* that I cannot but consider it as an extreme variety of that species, the more so as *D. annulata* is well known to be protean in its variations.

4. Triliacos dimidiata, Guer.

Scolia dimidiata, Guer. Voy. Coq. ii., 247, ♂; Burm. Mon. Scol., p. 15, 2; Smith. Cat. Hym. Ins. Brit. Mus., iii., 114, 138.

Campsomeris urvilii, St. Farg. Hym. iii., 503, 12.

Scolia analis, Fabr. Syst. Piez., p. 245, 37.

Liacos (Triliacos) analis, Saus. and Sich. Cat. Spec. Gen. Scol., p. 33, 1.

Scolia penangensis, Sauss. Mel. Hym., p. 39, 17, ♀ var.

Scolia erythrosoma, Burm. Mon. Scol., p. 15, 1; Smith., Cat. Hym. Ins. Brit. Mus. iii., 113, 134.

Liacos (Triliacos) erythrosoma, Sauss. and Sich., Cat. Spec. Gen. Scol., p. 35, 2.

Habitat: India, Burma, Malay Archipelago.

Female: Length 10 lines; expanse 18 lines.

Male: Length 9 lines: expanse 16 lines.

This species is an almost exact miniature of *Triscolia rubiginosa*, which apparently is common all over India.

Unlike any other species of the family known to me, *T. dimidiata* is often found swarming in considerable numbers round the stumps of decayed trees from December to February. On one occasion in the end of February I caught some thirty specimens in about a quarter of an hour. They were circling round the foot of an old stump in a field by the side of the road, and one sweep of the net would take in three or four specimens. From the circumstance that all I caught were males, I thought it possible that they were attracted, as some species of butterflies are, by the presence of a concealed virgin female, but a diligent digging and search in the ground round the stump resulted in nothing but the driving away of the swarming males.

Family Pompilidæ, *Leach*.

5. Pompilus bracatus, n. sp.

Habitat: Burma.

Female: Length 8 lines; expanse 15 lines.

Male: Length 8 lines; expanse 14 lines.

Description: ♀ Head dark ferruginous red, tips of the mandibles, a small patch round the ocelli, and the apex of the antennæ dusky black; the clypeus convex, nearly twice as broad as long, its anterior margin fringed with ferruginous hairs. Thorax, the prothorax, a square macula on the posterior portion of the mesothorax, the posterior margin of the scutellum, and the whole of the postscutellum ferruginous red, the rest of the thorax black with a silky lustre; the scutellum, postscutellum and metathorax slightly raised, the last convex with its apical margin distinctly recurved, and fine almost obsolete transverse striations; wings dark brown, with an oblique sub-hyaline yellow band crossing the middle; the legs have the coxæ trochanters, basal half of the femora, and the last joint of the tarsi with the claws dark brown, the apical half of the femora, the tibiæ and the basal joints of the tarsi bright ferruginous red, the tibiæ and tarsi have a few scattered spines. Abdomen silky black, smooth and shining.

♂ resembles the ♀, but the ferruginous red of the head and prothorax is of a lighter tint, inclining to yellowish, the mesothorax, scutellum, postscutellum and metathorax are silky black, the last with coarse well marked transverse striations, the wings are as in the ♀, but altogether of a lighter paler shade, and there is a dark brown opaque spot in the centre of the 2nd discoidal cell; the tibiæ and tarsi very slightly spinose; the abdomen slightly flattened, vertically.

This species was common in March and April in the Pegu hills, hunting about among the fallen leaves at the bottom of dry streams in a restless, hurried manner. I found its nest, a burrow in the ground at the roots of a large fern, and watched it storing the same with a small and very pretty species of cockroach brown with yellow markings. The conspicuous and brightly-coloured tibiæ and tarsi of this insect are very remarkable, giving it somewhat an appearance as if it had breeches on.

6. PRIOCNEMIS CONVEXUS, n. sp.

HABITAT: Ceylon.

FEMALE: Length 8 lines; expanse 14 lines.

DESCRIPTION: ♀ Head densely clothed with short silky ferruginous pubescence; the tips of the mandibles dark chestnut brown; the clypeus produced anteriorly and fringed with bright ferruginous hairs; the antennæ ferruginous, spirally convoluted. Thorax dark brownish black, the prothorax, mesothorax, scutellum and postscutellum covered with a short dense ferruginous pubescence, the dark ground colour showing through along the anterior margin of the mesothorax, and on the sides of the scutellum and postscutellum; metathorax black, convex, sloping posteriorly and transversely striated, the striations regular and well marked, the posterior face on each side ending in a well marked shoulder or ridge, anterior to which are two small tubercles; wings bright ferruginous, with an obsolete narrow fuscous border; legs ferruginous, the posterior and intermediate tibiæ and tarsi well serrated. Abdomen black, with a silky lustre, the 5th and apical segments with bright ferruginous pubescence, and their posterior margins with a fringe of stiff hairs of the same colour.

7. PRIOCNEMIS CRINITUS, n. sp.

HABITAT: Ceylon.

FEMALE: Length 8 lines; expanse 15 lines.

DESCRIPTION: ♀. Head black, clothed with a short dense golden pubescence intermixed with long silky hairs of the same colour; mandibles yellow, the tips dark brown; antennæ, the scape and two basal joints of the flagellum golden yellow, the remainder of the latter fuscous deepening into dark brown on the apical joints. Thorax black, the pro and mesothorax having long silky rather scanty golden pubescence, the scutellum, postscutellum, and metathorax clothed more densely with the same, the metathorax convex, with a central longitudinally impressed line; wings yellow hyaline, their apical margins faintly bordered with dusky black, nervures and tegulæ yellow; legs golden yellow, the coxæ and basal portions of the femora clothed with short golden pubescence, the apical joints of the tarsi and the claws dusky black; the tibiæ and tarsi of the intermediate and posterior legs strongly serrated. Abdomen black, covered with a thin short golden pubescence, and scattered long hairs of the same colour, the pubescence is more dense, forming well marked bands on the apical margins of the 1st, 2nd and 3rd segments; the 4th and following segments entirely clothed with golden pubescence.

8. MYGNIMIA RUBIDA, n. sp.

HABITAT: Ceylon.

FEMALE: Length 10 lines; expanse 17 lines.

MALE: Length 6 lines; expanse 12½ lines.

DESCRIPTION: ♀ and ♂ alike, of a rich light chestnut red colour all over, smooth and shining. Wings bright ferruginous hyaline, a white transparent oblong spot with an opaque nucleus or centre at the base of the 2nd discoidal cell, the 1st recurrent nervure unites with the second transverso-cubital nervure; the tibiæ and tarsi of the intermediate and posterior legs strongly serrated, the posterior tibiæ flattened above and grooved longitudinally.

The three above described new species of *Pompilidæ* from Ceylon were kindly sent to me by Mr. E. E. Green of Eton, Pundoloya.

9. MYGNIMIA AUDAX, Smith.

Mygnimia audax, Smith. Cat. Hym. Ins. Brit. Mus. iii., p. 182, 4.

HABITAT: Silhet, Kumaon.

FEMALE: Length 15 lines; expanse 27 lines.

DESCRIPTION: ♀ Head clothed with ferruginous pubescence, very bright on the clypeus and front, darker on the cheeks and vertex, mandibles ferruginous chestnut brown at the tips, antennæ convolute. Thorax ferruginous brown, the pubescence on the prothorax, mesothorax above, and the scutellum having a golden tint; the metathorax dark brown, broadly convex, and with well-marked transverse striations, its apex terminating in a conspicuous recurved rim; wings bright ferruginous, the outer margins pale fuscous, a transparent ocellus with a dark nucleus or centre at the base of the 2nd discoidal cell; nervures and tegulæ ferruginous; legs, the coxæ trochanters and upper half of the femora brown; the apical half of the femora, the tibiæ and tarsi ferruginous; the tibiæ and tarsi of the intermediate and posterior legs strongly ciliated and spined; the posterior tibiæ flattened and longitudinally grooved above. Abdomen, the 1st segment dark brown at base, its dorsal surface turning to bright ferruginous in the middle; the 2nd to the 4th segments clothed with short silky ferruginous pubescence at base, the posterior margins with broad dark brown bands which are continued on the under surface, the apical segments ferruginous.

This very handsome species was originally received from Silhet; it probably occurs throughout the Himalayas. The specimens in my collection I owe to the kindness of Miss A. Brooke.

10. FERREOLA FENESTRATA, Smith.

Ferreola fenestrata, Smith. Cat. Hym. Ins. Brit. Mus., III., 169·9.

HABITAT: India (Madras); Burma.

FEMALE: Length 7 lines: expanse 12 lines.

MALE: Length 5 lines: expanse 8 lines.

DESCRIPTION: ♀ and ♂ alike. Head black with a silvery sericeous pile in freshly-captured specimens, a narrow yellow line borders the inner and outer orbits of the eyes, interrupted at the vertex, antennæ longer and more filiform in the ♀ than in the ♂. Thorax, the pro and mesothorax brick red, the scutellum, postscutellum and the metathorax black clothed with a thin silvery pile, the prothorax and the metathorax in the ♂ are considerably longer proportionally, than the same parts in the ♀; in both the metathorax is vertically flattened with lateral tubercles, while its posterior face is deeply concave; wings clear silvery hyaline for one-third of their length from base, the apical portions being dark fuscous with a shining purple effulgence; legs black with silvery pile, the anterior tibiæ smooth, the intermediate and posterior tibiæ and tarsi have a few stout scattered spines. Abdomen clothed with a blue black shining pile in the ♀: in the ♂ the 1st and 2nd segments are black with a thin silvery pile, the remaining segments blue as in the ♀.

The above does not quite correspond with Smith's description in the Catalogue of the Hymenoptera, British Museum, which gives the prothorax only as "ferruginous;" whereas in my specimens the pro and mesothorax are not ferruginous, but, as I call it, a light brick red; but then the rest of the insect agrees so well with Smith's account of F. FENESTRATA, that I cannot but think his failure to note the colour of the mesothorax due to an oversight only.

This species is quite common in Burma in August and September, frequenting low bushes and grass.

11. FERREOLA GREENII, n. sp.

HABITAT: Ceylon.

FEMALE: Length 8 lines: expanse 13 lines.

DESCRIPTION: ♀ Head black covered with a fine silvery sericeous pile, the front between the antennæ produced into a tubercle overhanging the clypeus, which is much broader than long; antennæ subfusiform. Thorax black, the prothorax, the mesothorax, the scutellum and a narrow margin posteriorly on the postscutellum covered with a silvery sericeous pile like the head; the anterior portion of the postscutellum, the metathorax and the abdomen clothed with a rich violet iridescent pile. Wings silvery hyaline for almost half their length from base, the apical half dark fuscous with a brilliant deep purple effulgence, nervures and tegulæ black; the anterior legs with the coxæ trochanters and femora of the intermediate pair black with a thin silky white pile, the intermediate tibiæ and tarsi and the whole of the posterior pair of legs have the same rich dark iridescent violet pile as the methathorax and abdomen.

This very beautiful and well-marked species I have ventured to name after its discoverer Mr. E. E. Green. Mr. Green favoured me with the following interesting note with the type specimen: "The *Ferreola* (marked B) was reared from a cocoon found in what had evidently been a large spider's nest between two leaves; the grub had evidently been feeding upon the eggs of the spider."

12. Ferreola fasciata, n. sp.

Habitat: Burma.

Female: Length 7 to 12 lines: expanse 11 to 18 lines.

Description: ♀ Head black, clothed with a thin grey silky pile; antennæ jet black; thorax black, the prothorax covered with short, dense grey pile on the anterior and posterior margins, in the middle the ground colour shows through like a black crescent, the rest of the thorax covered very thinly with grey pile; wings clear hyaline for one-third their length from base, the apical portion fuscous with a dull purplish effulgence, nervures and tegulæ black; legs black with thin grey silky pile. Abdomen blue black, the base of the 1st segment, and the posterior margins of the 1st, 2nd, and 3rd segments with transverse bands of dense silvery pile, these bands are partially interrupted on the dorsal surface, but are continuous on the under side of the abdomen.

I have found this species only in dense forest by streams at 2,000 feet elevation and above. I have not succeeded in taking a male.

Family Sphegidæ, Leach.

13. Sphex tyrannica, Smith.

Sphex tyrannica, Smith. Proc. Linn. Soc. V. p. 122, 5.

Habitat: Batchian; Kaioa; Gilolo; Timor; Sula; Mergui (Tenasserim).

Female: Length 13 lines: expanse 23 lines.

Description: ♀ Head black, closely and very finely punctured and clothed with erect black hairs, the face on either side of the clypeus and below the antennæ has a thin silvery pile only visible in certain lights; clypeus circular convex, its anterior margin with a recurved rim, mandibles black with an acute tooth on the inner margin, antennæ opaque black; thorax black, the prothorax notched longitudinally, the mesothorax clothed with a short, thick, black velvetty pubescence, and having two short and scarcely perceptible impressed lines on the disc; the scutellum and postscutellum black, the former with a shallow longitudinal groove in the middle, the latter slightly projecting; the metathorax long, rounded, transversely striated and clothed with a thick velvetty black pubescence mixed with erect black hairs; wings dark brown with a conspicuous broad fuscous black border along their apical margins, the basal portion of the wings are shot with a brilliant purple effulgence; legs black, the anterior femora, tibiæ and tarsi, and the intermediate and posterior tibiæ and tarsi studded with black hairs and spines, calcaria black, claws dark chestnut brown. Abdomen black, smooth and shining, the petiole short.

I captured two specimens of this insect in November at Mergui. It is remarkable that it should be found in Burma, as Wallace only procured it far south in the Malay Archipelago.

14. SPHEX FULVO-HIRTA, n. sp.

HABITAT: Ceylon.

FEMALE: Length 13½ lines: expanse 21 lines.

DESCRIPTION: ♀ Head a little wider than the thorax black, mandibles armed with two teeth on the inner margin, their base longitudinally striated and grooved, clypeus convex clothed with black pubescence and stiff black hairs, antennæ black, face, vertex, and cheeks clothed with velvetty black pubescence; thorax black, the prothorax, the mesothorax, the scutellum, and postscutellum covered with a dense short velvetty black pile; the scutellum and postscutellum raised, and notched longitudinally down the middle, the latter having the appearance of two tubercles side by side; the metathorax long, rounded, clothed above and on the sides with dense soft fulvous pubescence, wings hyaline, brownish yellow at base, fading to a light yellow towards the apex, and having a broad apical margin to both anterior and posterior wings of faint dusky black, tegulæ black, nervures yellow; legs black, claws dark chestnut brown with their tips black. Abdomen black, very smooth and glossy, the petiole rather short.

Type specimen captured by Mr. E. E. Green and kindly sent to me.

The two above described species belong to the IVth Division of the Sphegidæ "*Tarsal claws with two teeth* (*Sphex sensu str.*)" as laid down recently by Mr. Cameron in his brochure "Hymenoptera Orientalis; or, Contributions to a Knowledge of the Hymenoptera of the Oriental Region."

Family BEMBECIDÆ, Westw.

15. BEMBEX FOSSORIUS, Smith.

Bembex fossorius, Smith. Jour. As. Soc. Beng., Vol. XLVII. (1878). pt. II., p. 168, 7.

HABITAT: Burma (Pegu Hills), Tenasserim.

FEMALE: Length 8½ lines: expanse 18 lines.

DESCRIPTION: ♀ Head about as wide as the thorax; mandibles yellow, their tips dark chestnut brown; clypeus yellow, convex, rounded above, slightly emarginate anteriorly, the front and cheeks a slightly darker yellow, with in certain lights an almost obsolete silvery pile; antennæ black, the scape in front washed with yellow, the vertex and the back of the head black clothed with a soft silky grey pubescence. Thorax black, smooth and shining above, though very finely punctured, the posterior margin and the sides of the prothorax, a line over the tegulæ, a square parenthesis-shaped mark on the posterior margin of the scutellum, a crescentic narrower mark on the postscutellum, with a similar mark on the posterior face of the metathorax lacteous yellow, the sides of the thorax yellow; wings clear hyaline, the tegulæ black, nervures brownish yellow; the legs yellow, the coxæ femora and tibiæ of the anterior and intermediate legs posteriorly, and the coxæ femora, tibiæ and tarsi of the posterior pair of legs both anteriorly and posteriorly striped with black, the last joint of the tarsi and the claws chestnut brown. Abdomen black, shining, very finely punctured, the first to fifth segments with broad submarginal bisinuate bands on the dorsal surface not continued on the under side of a dull lacteous yellow, apical segment black.

This species was first obtained by Mr. Ossian Limborg in Tenasserim. I have found it common in the Pegu Yoma and in the hills in Tenasserim. In April it has a habit of swarming in great numbers and digging into the sandy banks of streams, cuttings on a road, &c. I watched one at work, a female; she dug rapidly somewhat like a dog with her fore feet, and when the hole was deep enough to contain her whole length, pushed out the loosened sand with her hind legs.

Tribe DIPLOPTERA, *Latr.*

Family EUMENIDÆ, *Westw.*

16 ZETHUS CYANOPTERUS, de Sauss.

Zęthus cyanopterus, de Sauss. Mon. Guêpes. Sol, Supp. p. 116. Smith. Cab. Hym. Ins. Brit. Mus. V. 9. 1.

Calligaster cyanoptera, de Saus. Mon. Guêpes. Sol. 23, 2, ♀.

HABITAT: Java, Burma.

FEMALE: Length 9 lines; expanse 15 lines.

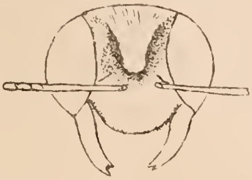
DESCRIPTION: ♀ Head black; mandibles narrow, their base pubescent; the clypeus circular, convex and pubescent, a small tubercle on the front between the antennæ, the scape of the latter shining but coarsely punctured, the flagellum opaque black, vertex and cheeks black, shining and coarsely punctured, the former slightly pubescent. Thorax black; the prothorax coarsely punctured, the punctures running into striæ; the mesothorax long, flattened vertically, smooth and shining, the disc having two longitudinally impressed lines which do not reach its anterior margin; scutellum, postscutellum, and metathorax in one plane sloping obliquely backwards, the last having a broad shallow groove longitudinally down the middle, the edges of which are sharp; wings fuscous brown, with a rich purple effulgence; legs black, claws of the tarsi bifid. Abdomen black and shining, finely punctured and slightly pubescent, the first segment somewhat flattened, forming a petiole as long nearly as the head and thorax taken together, the second segment with a short petiole, its apical margin with a recurved rim, the remaining segments telescopically closing into the second segment.

This species is rare in Burma. I procured it in the Pegu Hills, and at Tavoy in November, frequenting flowers.

Family VESPIDÆ, *Steph.*

17 ISCHNOGASTER EXIMIUS, n. sp.

HABITAT: Ceylon.



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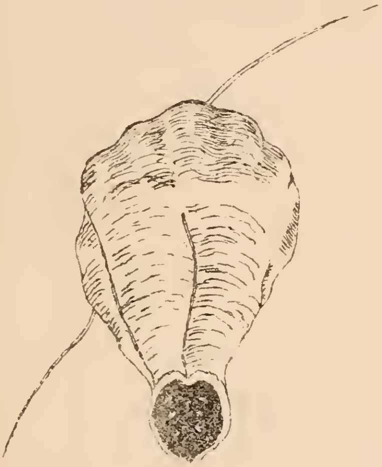

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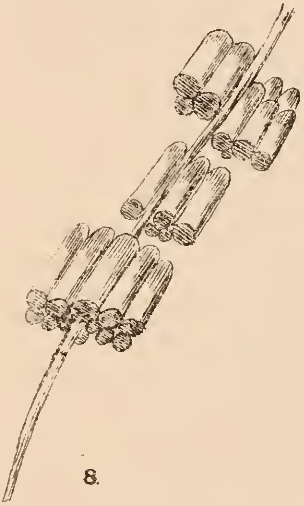


8.

7. Nest of *Ischnogaster eximius* (actual size)

8. Nest of *Ischnogaster nigrifrons* (do. do.)

9. Front view of head of *Ferreola greenii*, showing remarkable tuberculated front above the clypeus.

MALE: Length 10½ lines; expanse 15 lines.

DESCRIPTION: ♂ Head rather broader than the thorax; mandibles light brownish yellow, much produced, forming a long beak; clypeus lengthened slightly convex, ending in an acute tooth, from which a short raised carina or ridge runs vertically up; the front below the antennæ and the clypeus, dull opaque yellow, clothed with a fine short silky white down; antennæ, the scape, and the basal and two apical joints of the flagellum pale brownish yellow, remainder of the flagellum brown; vertex and cheeks brown, the former garnished with a few long silky pale hairs; ocelli in an equilateral triangle, the anterior ocellus larger than either of the two posterior ones. Thorax dark brown, the posterior margin of the prothorax having a band of yellow, which is interrupted in the middle, but widens out considerably on the lateral angles; the tegulæ, two spots on the sides below the wings, a sub-triangular spot on either side at the base of the scutellum, the anterior margin of the postscutellum, and a long oval macula on the posterior angles of the metathorax opaque yellow; wings hyaline, of a light yellowish brown colour, somewhat darker along the costal margin; the nervures testacous; the stigma and radial cells lengthened, three complete cubital cells, the 4th almost complete, the 2nd cubital cell long, its sides forming a parallelogram, receiving both recurrent nervures, the 1st very near its base, the 2nd near its apex; the 3rd cubital cell almost square; legs testaceous yellow, the claws of the tarsi with a distinct tooth, the intermediate and posterior tibiæ with two spines. Abdomen, the 1st segment forms a long petiole, distinctly thickening from base to apex; 2nd segment dark brown, its base clothed with a fine short silky golden pile; 3rd and 4th segments dark brown, with broad lateral fasciæ of golden pile; 5th and apical segments testaceous brown at their base, with like lateral fasciæ of golden pile, and a brown spot beyond them on each side; below the abdomen has the petiole ferruginous, the 2nd and following segments dark brown, the 2nd segment with a spot of golden pile at its base, the remaining segments with broad sub-interrupted marginal bands of the same.

This very beautiful insect was kindly sent to me by Mr. E. E. Green, who has also since been good enough to forward a few of its nests with the following note:—"I am now sending you by parcel post a few of the nests of the insect. I do not think it is a social wasp. Each nest seems to be the property of one pair only. It is a low country insect. The nests were sent to me by a friend who was then stationed near Galle. The wasp I sent you was hatched out of the cells of one of these nests. My friend (Mr. John Pole, a very accurate observer,) assures me, he has repeatedly seen this same species and no other associated with these nests. The nests now sent have been rather damaged, and have lost the perforated vestibule which they have when complete. Mr. Pole writes of the wasps: 'their habit seems to be to remain in the opening, using the lace-work at the bottom as spyholes.' "

The insects belonging to the genus *Ischnogaster* seem to be the links joining the solitary and social tribes of the *Wasps*. They resemble the solitary wasps in having the claws of their tarsi toothed below, and in sometimes, as in the case of the species above described, living in pairs, constructing a solitary nest. Again their affinity to the social wasps is seen in the armature of the tibiæ of the intermediate and posterior legs, which, as in the true *Vespidæ,* have *two* spines each, and *I. nigrifrons*, Smith, which is common here in Burma, does to my certain knowledge construct a social many-celled nest, tier above tier, as the allied *I. Mellyi* is stated to do by de Saussure.

Tribe ANTHOPHILA, *Latr.*

Family ANDRENIDÆ, *Leach.*

18. CTENOPLECTRA CHALYBEA, Smith.

Ctenoplectra chalybia, Smith, Proc. Linn. Soc. II. 45, 1, ♀.

HABITAT: Malacca; Celebes; Burma (Pegu Yoma); Tenasserim.

FEMALE: Length 4½ to 6 lines; expanse 7 to 9 lines.

DESCRIPTION: ♀ Head black, as broad as the thorax; the clypeus large, slightly convex and sparsely punctured, the face on each side with a little silky white pubescence; the vertex and cheeks finely but densely punctured; the antennæ pitch black. Thorax black, smooth and shining; the scutellum rather coarsely punctured; the metathorax with sparse whitish pubescence fringing its sides; wings hyaline, the tegulæ and nervures black; legs black, densely clothed, especially the posterior pair, with black pubescence and bristles; tarsi and claws testaceous brown; the tibiæ of the posterior pair of legs flattened and broad, the calcaria at the apex of the intermediate tibiæ stout, acute and bent at the apex, its hinder margin toothed like a fine comb, the inner spine of the posterior calcaria also toothed, forming a comb-like process much more conspicuous. Abdomen black, with in certain lights a steel-blue lustre, its under surface furnished with a number of thread-like bristles.

This remarkable little bee I have procured in April in the Pegu Hills, and in August in Tenasserim. Smith says it is closely allied to *Macropis;* in habits it resembles *Megachile;* I have watched it carrying a fragment of a leaf to a hole in the post of a wooden house.

Family APIDÆ, *Auct.*

19. MEGACHILE ATRÁTA, Smith.

Megachile atrata, Smith, Cat. Hym. Ins. Brit. Mus. I. 182, 112.

HABITAT: Philippine Islands; Tenasserim (Mergui).

FEMALE: Length 9 lines; expanse 17 lines.

DESCRIPTION: ♀ Head black, the mandibles porrect, very broad, armed with 4 teeth, and clothed with a short rather scanty stiff black pubescence, the disc of the clypeus, the front between the antennæ, the vertex and cheeks finely and closely punctured, above and on the sides of the clypeus a little tufty black pubescence; antennæ black, the scape shining, the flagellum opaque; thorax broad, closely punctured, the sides of the thorax and the metathorax posteriorly clothed with dense black pubescence; the mesothorax has a longitudinally impressed shallow line on the disc, and the scutellum is roughly sculptured; wings fulvo-hyaline with a broad marginal band dusky black; the legs black, clothed with black bristly hairs, the apex of the last joint of the tarsi and the base of the claws chestnut brown. Abdomen black, finely pitted and rather sparsely covered with short black pubescence, the 1st to the 4th segments have narrow sub-marginal transverse grooves, the margins beyond being smooth and shining; the 5th and apical segments clothed with dense black pubescence, the pollen brush very full and jet black, with just a touch of reddish yellow at the base of the 2nd segment below.

I think there is little doubt that this is Smith's species from the Philippines, the remarkable broad porrect mandibles projecting in a line with the clypeus, and Smith's note that the wings are sometimes yellow with a fuscous margin are conclusive.

I found this species very common at Mergui in November, frequenting in great numbers the flowers of the Anatto (*Bixa orellana*). I discovered several nests, all excavated on the face of a bare hard plain covered with short grass. The tunnels were about ⅓rd of an inch in diameter, and ran perpendicularly down for from 4 to 7 inches, and then diagonally at angle of 50° or thereabouts for another 3 or 4 inches. In all the nests I found little rolls of the leaf of the anatto plant stuffed full of pollen. In some of the rolls I found a tiny opaque white egg, in others a transparent grub lying head downwards. What puzzled me, however, was that in a nest containing a number of rolls (seven being the greatest number I found in any one nest) it was always the top rolls, nearest the surface of the ground, that contained the grub; the eggs in them seemingly being the first to hatch out though the last to be laid.

20. MEGACHILE BADIA, n. sp.

HABITAT: Burma (Pegu Yoma).

FEMALE: Length 9 lines; expanse 15 lines.

DESCRIPTION: ♀ Head broad as the thorax, black; mandibles broad, sculptured with delicate longitudinal striæ; clypeus broader than long, densely punctured and having a T-shaped raised carina on its disc; face above up to the anterior ocellus clothed with black pubescence; rest of the head black, finely and closely punctured. Thorax black, densely punctured, clothed with brownish black hair on the sides and on the posterior face of the metathorax; wings fulvo-hyaline, with a broad fuscous margin; legs black, the claws and calcaria dark chestnut brown. Abdomen black, very closely and finely punctured, and clothed rather sparingly with black pubescence; the 1st and 2nd segments have besides narrow submarginal bands of deep fulvous red pubescence; pollen brush black.

This species closely resembles the last, but is abundantly different in form, and conspicuous in having the two fulvous red bands on the abdomen.

I took the type specimen on the Pegu Yoma in December. I have not as yet met with it in Tenasserim.

21. Megachile tuberculata, Smith.

Megachile tuberculata, Smith. Proc. Linn. Soc. II p. 46, 5.

Habitat: Borneo; Singapore; Burma (Pegu Yoma); Tenasserim (Mergui).

Female: Length 10 to 12 lines; expanse 18 lines.

Description: ♀ Head as broad as the thorax, black; the mandibles long, very stout, striated longitudinally, their inner margins furnished with a prominent tooth close to the base, the apex ending in three large teeth, the lowest one acute; clypeus black, covered rather sparingly with black pubescence, the upper portion projecting obliquely forward, and so forming a large and very prominent tubercle, below this tubercle the plane of the clypeus is bent vertically down at an angle; the front between the antennæ, the cheeks, and back of the head clothed with black pubescence, the vertex and space round the ocelli closely punctured. Thorax black, rather coarsely and densely punctured, clothed with black pubescence, which on the lateral angles of the scutellum and on the face of the metathorax fades to a pitchy brown; wings fulvo-hyaline, with broad fuscous margins; legs black, clothed with black pubescence, the claws dark chestnut brown. Abdomen black, covered with short stiff black pubescence; the pollen brush black.

This, one of the largest of the leaf-cutter bees, is rare in Burma. It is easily identified by its remarkable tuberculated clypeus.

22. Megachile luculenta, n. sp.

Habitat: Tenasserim (Thoungyeen Valley; Tavoy).

Female: Length 11 lines; expanse 18 lines.

Description: ♀ Head large, broad as the thorax; mandibles broad, sparsely punctured, black, their outer margins fringed with black hairs, the apex furnished with four teeth, the two lower ones very acute; clypeus black broader than long, closely punctured, vertical, forming a marked transverse ridge with the plane of the face, which, from the vertex to the upper margin of the clypeus, slopes obliquely forward, anterior margin of the clypeus truncated and bisinuate; the antennæ, the front vertex and cheeks black, the face has a little black pubescence on each side, the vertex and cheeks closely punctured and covered sparsely with black hairs; the ocelli arranged in a curve. Thorax black, coarsely punctured, the prothorax, the postscutellum, the metathorax and the flanks clothed with black pubescence which on the postscutellum and the metathorax is tipped with hoary white; the pectus black sparsely punctured and clothed rather sparingly with scattered black hairs; the wings at base fulvo-hyaline, the apical margins of both wings broadly bordered dusky; legs black with black pubescence, the calcaria and claws dark chestnut brown, the basal joint of the posterior tarsi clothed with deep ferruginous red pubescence. Abdomen black, covered above and below with a rich dark ferruginous red pubescence.

This species is closely allied to *M. fraterna*, Smith, from which, however, apart from its considerably larger size, it differs conspicuously in the colour of the pollen brush. In the present species this is of a rich glistening ferruginous red; in *M. fraterna* it is golden yellow.

Minor differences are, the shape of the clypeus and mandibles and the colour of the posterior pair of legs, which in *M. fraterna* have the femora and tibiæ inwardly and the tarsi fulvous.

The type specimen of this insect I captured at Tavoy in October. Subsequently I found it frequenting with other hymenoptera the wet sands on the banks of streams in the Thaungyeen valley along the Siamese frontier.

23. ANTHOPHORA BROOKIÆ, n. sp.

HABITAT: KUMAON.

FEMALE.: Length 7 lines: expanse 13 lines.

DESCRIPTION: ♀ Head black finely punctured; mandibles yellowish white, their tips ferruginous; labrum produced yellowish white with two minute spots at its base and its anterior margin narrowly black; clypeus yellowish white, slightly convex; a raised carina vertically down its centre, with two oblong large black maculæ, one on either side; the clypeus and labrum studded with black hairs; antennæ pitch black; the vertex cheeks and front clothed with fulvous pubescence. Thorax black, densely clothed above and below with rich fulvous pubescence; wings hyaline, tegulæ and nervures testaceous; legs black clothed inwardly with black, and outwardly with fulvous pubescence, the tarsi of a testaceous brown. Abdomen black, very thinly covered above with fulvous pubescence fading to silky white along the margins of the segments, thus forming transverse bands of white, the apical segment with black pubescence. Below the abdomen is black finely pitted, with the margins of the segments narrowly testaceous.

This beautiful little bee I have ventured to name after Miss A. Brooke, to whose kindness I owe many rare and beautiful hymenoptera collected in Kumaon.

The nearest ally to it is *Anthophora fasciata* of Fabricius, which, however, has cinereous and not fulvous pubescence.

24. XYLOCAPA ÆSTUANS, Linn.

Apis æstuans, Linn. Syst. Nat. I. 961, ♀; Fabr. Ent. Syst. II. 323.

Apis leucothorax, De Geer, Mem. III. 573. pl. 28. f. 7.

Bombus æstuans, Fabr. Syst. Piez. 351.

Xylocapa æstuans, St Farg. II. 193, ♂, ♀; Smith, Cat. Hym. Ins. Brit. Mus. II. 353.

Xylocapa verticalis, Smith, Jour. Linn. Soc. II. 48, ♂, nec St. Farg.

HABITAT: India; China; Borneo; Java; Bali Island; Sumatra; Celebes; Aru; Timor; Palestine; Aden.

DESCRIPTION: "The female is black; the pubescence black except that on the thorax above, which is yellow, and does not extend beneath the wings; the wings black-brown, with bright purple iridescence at the basal portion, beyond which it has a greenish tinge. The male is clothed with yellow pubescence; on the abdomen it has a greenish or olivaceous tinge; on the legs it is greenish-yellow, on the intermediate and posterior tarsi it is black, with a mixture of yellow outside; the abdomen has some black pubescence at the sides towards the apex; the wings fusco-hyaline, darkest in the marginal cell, with a purple iridescence in certain lights. Female, length eight to ten lines; of the male eight to nine lines."

25. XYLOCAPA BRYORUM, Fabr.

Apis bryorum, Fabr. Ent. Syst. II. 321, ♂.

Bombus bryorum, Fabr. Syst. Piez. 348.

Xylocapa dimidiata, St Farg. Hym. II. 199, ♀.

HABITAT: Australia.

DESCRIPTION: "This species very closely resembles *X. æstuans*, in both sexes; the female differs in having the head clothed with cinereous pubescence, and the abdomen has sometimes, but rarely, a little yellow pubescence in the middle of the base, this is usually abraded; the wings are a degree lighter than in *X. æstuans*, the male scarcely differs from it; it is usually rather larger than any specimen of *X. æstuans* male, the posterior tibiæ are more incrassate, and the pubescence on the tarsi is more ferruginous; the species is also a degree larger."

The above descriptions of two very closely allied species of "Carpenter bees" are taken from Smith's Monograph of the genus published in the Trans. Ent. Soc. Part II., April 1874, and though not full and detailed, are suficient to enable one to note the difference between the two species. Both occur in Burma, but whereas in Pegu and Lower Burma generally *X. æstuans* is the common form, from Tenasserim I have only got *X. bryorum.*

MULES.

By J. H. Steel, A.V.D.,

Principal, Bombay Veterinary College.

(Read at the Society's Meeting on 11th August 1890.)

Among animals of transport the hybrid of the horse and the ass holds an honoured place, and has done so through ages. This is due to sterling qualities which have enabled him to overcome prejudice and in many cases force his way by proved superiority as a baggage animal, by hardihood, strength, independence of character, and certain other good qualities. Thus, he has now become an object of much attention from Government and the public in India, his superiority for military transport having been fully established in many a hard-fought campaign, and the mule-breeding industry is a lucrative one to those who take it in hand. Several small books and pamphlets have been written on the mule, but there is still room for a larger and more comprehensive work on so important an animal.

The first point we have to decide is, *what is a "mule?"* The pre-eminence among hybrids of the equine has caused the term "mule" to be applied in a general as well as a special manner. Thus we hear of mule canaries—crosses between the common canary and an allied species. Crosses are not so uncommon as is generally supposed. Thus:—

(*a*) The one-humped and the Bactrian camel are crossed in Asia Minor, and the result is a hybrid considered most useful and preferred on account of vigour of constitution. It is said that if the dam be a dromedary and the sire a camel, the progeny works well; but if the dam be a camel, the offspring is ill-tempered and intractable.

(*b*) The Bos taurus and Bos Indicus are very frequently crossed in this country, and the progeny is said to be inferior in constitution to the indigenous race, so it has not made much progress. However, we have as yet little true knowledge concerning this cross.

(*c*) In the Himalaya Bos grunniens, the yak, is frequently crossed with the common ox of India; and Moorcroft, after telling us to use mules preferably to small horses for mountain journies, says: "For the Himalaya, the beast that excels all in caution and security is the jabu or mule from the yak of Tartary and the cow." (*Travels.*)

Among equines we have the following recorded:—

(*a*) Ass with mare.
(*b*) Horse with female ass.
(*c*) Zebra with ass (Ann. du Mus., VII. 245, and IX. 223; F. Cuvier, Hist. Nat. des Mam., 1820; Geoffroy; Gray's Knowsley Gleanings).
(*d*) Zebra with horse. (Ann. du Mus., XI. 237-240).
(*e*) Quagga with Arab mare (Phil. Trans. 1821, p. 90).
(*f*) Ass with Cutch wild ass mare.
(*g*) Onager with Syrian wild ass (Animals in Gardens of Zoological Society of London, 1883).
(*h*) Ass-zebra with mare in Zoological Gardens, London (Darwin).
(*i*) She-mule and ass. Zopyrus, Herodotus III. 153 long 151.

Thus, what are usually described as species are very commonly capable of crossing, and the old definition of species does not hold, or we have been in error in breaking up camels, horses, cattle, and other genera into various species. That the rigid interpretation of species is a mistake has been thoroughly established by Darwin, who has shown clearly what previously had been known, but not scientifically expressed, that the animal organism is "plastic in the hand of man." Nature seldom resorts to abrupt changes in development; usually progress is gradual in the extreme, and the results the more sure. One of the essentials to organic development is a limitation of the power of inter-crossing; and the germ of the physiological, anatomical, and other characters of a species opposes the production of distant hybrids. However, no two individuals are alike; variety does not *appreciably* impede crossing; and the allied species of a group even are capable of producing hybrids. There is no abrupt line to be drawn by science in this matter of crossing, no hard and fast boundary, but there is a tide mark of a certain range, and within the limits of that range the result of crossing is doubtful; inside the range crossing is certain; outside it is impossible, although certain most extraordinary "yarns" of crossing most diverse species have from time to time gained acceptance from the public, and occasionally from scientific workers. Crosses actually occur in nature. For example, Prejevalsky in Thibet saw among other wild equines, mules, and his observations agree with those of previous travellers, and should permanently dispel the view that mule-breeding is unnatural and contrary to divine laws, which is occasionally an impediment to its expansion in this country and elsewhere.

The *infertility of hybrids* is well exemplified in the case of mules, for it is almost invariably a fact with them. Although a few cases are on record in which the he-mule has begotten progeny and the female has come in foal, I know of no authenticated instance of a foal being born with a mule for its sire and another mule for its dam. "When mules breed," was the favourite expression among the Roman soothsayers to indicate hopelessness as to the issue of occurrence of events, and yet in history there have been occasions when mules *did* breed. These are for the most part pure fables, but they indicate a general impression that such an extraordinary event does occasionally come off, now and again in a long lapse of ages.

One of the most energetically discussed problems of the present day is the question of *degrees of hereditary transmission from the parents respectively* and from other ancestors. It is a matter of general observation that in features some children take after the father, and others after the mother—and statistics have been drawn up to elucidate the rule which underlies this phenomenon. The result is much discussion and various theories. A study of mules promises to throw a great deal of light on the matter, for the difference in species of the parents makes their specific characters distinctive. We know there is a marked difference between the *true mule* or progeny of a donkey sire and a mare on the one hand, and the *hinny* or progeny of a horse and a female donkey. Both present a mixture of cabaline (*i.e.*, true horse) characters and asinine—but the mixture is in different proportions. The size of the female parent is followed, and as a rule the shape of the male; yet there seems a specially strong determination to inherit from the ass. Thus the large ears, tufted tail, donkey marks, colour, narrow hoofs, hog mane, obstinate temper, low forehand, big head, and scanty neck, are as seen in the ass. These characters are, however, diluted as it were by the cross, and not to be considered as entirely uninfluenced, and all stages of transition are, in different cases, though not in the same individual, found beween cabaline and asinine characters in the mule. We need some exact observations and measurements of mules, which some of our members who are Transport Officers up-country could very readily furnish us with, and which would have high scientific value. Such observations have to a limited degree been applied to the skeleton, and it is remarkable how the facts just mentioned apply to the internal as well as the external structures. There can be no doubt as to the strong influence of heredity on both sides; but it is the relative degree of the respective heredities which we wish to get at.

An extraordinary influence is exerted on the system of the mare by becoming the mother of a mule, in so far as her progeny in the future is liable to a taint indicated by asinine characters cropping up. Thus no brood mare of high value should be made to throw a mule—a fact well established by the experiment made by Lord Morton of crossing a mare of pure blood with a quagga. It is probably not quite realised in our social relations that one may naturally resemble his step-father, yet such is quite possible to the progeny of a second marriage.

Mules have an extraordinary number of peculiarities which may be considered distinctively their own. These are a matter of common experience and do not always favourably impress people who have to do with them, as is shown by the common sayings, "Vicious as a mule," "Obstinate as a mule," and so on. Among equines, mules are characterised by a peculiar mental distortion, "crankiness," as it may be termed, which sometimes proves very embarrassing to those who, accustomed to horses or even donkeys, have to deal with mules, for the first time. Writers on travels record some of these. Galton, for example, says:—

"Mules require men who know their habits; they are powerful beasts, and can only be mastered with skill and address. A savage usually fears their heels, and will not assist in packing them. They have odd secret ways, strange fancies, and lurking vice. When they stray they go immense distances, and it is almost beyond the power of man on foot to tend them in a wild country. The female is in most breeds the most docile. They suffer from African distemper, but in a less degree than horses." And again:

"The instincts of the mulish heart form an interesting study to the traveller in the mountains. I would liken it to a woman's, for it is quite as uncertain in its sympathies, bestowing its affections when least expected, and when bestowed quite as constant, so long as the object is not taken away." It is customary to have a horse in the mule train of the traders of Northern Mexico, as a sort of magnet to keep together the separate atoms of the train, for, whatever the temptation, they will never stray from him (*Taylor's Eldorado*).

From personal observation I quite agree that mules are animals of which one can get very fond, that they take an intelligent interest in what is going on around, and are rarely troublesome when they know what is expected of them. A mule must not be handled like a horse, his long ear and narrow jaw against the tushes give excellent hold of the head. He strikes cleverly with his fore-feet. Such, then, are some of the questions which hinge round the subject of mules.

Let us next proceed to consider some practical matters as regards these most interesting animals.

Premature birth is said to be frequent in mule-breeding, though the mule, as a rule, is carried longer than an ordinary horse foal by the mare. Although fecundation of the hybrid female by the ass or horse is not rare, abortion generally occurs.

There is often no anatomical or physiological reason why a mule should not breed, but generally there is a very imperfect development of the requisite parts.

The hinny is generally much inferior in useful qualities to the true mule, its tail is more like that of a horse, its ears shorter, and its shape equine.

The voice of the mule is neither that of the horse nor of the ass, but a queer, shrill, feeble, and hoarse sound; a chorus of mules welcoming the call to "feed" is most comical.

The following points in description of hybrids are interesting, often as indicating tendency to reversion to original type:—

(*a*) The hybrid ass zebra and mare when young had shoulder, flank, and leg stripes, but when adult hardly any stripes. (Darwin's *Variation under domestication of Plants and Animals*, ii. p. 68, note.)

(*b*) The cross of the zebra with the ass has his legs very striped.

(*c*) Lord Morton's celebrated cross of a quagga with an Arab mare had the legs more striped than the quagga. (*Philosophical Transactions*, 1821, p. 20.)

(*d*) The same mare threw two foals by a black Arab sire, which colts had striped legs, and one had stripes also on the body.

(*e*) The cross of a wild ass of Cutch with a male ass had all four legs transversely and conspicuously striped, three short stripes on each shoulder and zebra stripes on the face.

(*f*) A second specimen of the same breeding was similarly marked.

(*g*) Mules have generally their legs more striped than horses or asses.

The next point I will draw attention to is *the sources of supply.* Mules come from very many parts of the world. In North and South America they are bred extensively, those of Kentucky, Minnesota, and Missouri being well known. The Mexican mules, resulting from the ass crossing with mustang mares, also have a good reputation. In Europe, France, Spain, and Italy are the main source of supply, those derived from Poitou being especially fine; North and South Africa, Asia Minor, Cyprus, Syria, and Persia, also China, may be included in the list of places whence mules may be obtained.

I would here call attention to the most significant fact that *the best places for mules are those which are not renowned for good horses.* This must be taken as a note of warning for those who are most anxious to expand mule-breeding operations in Beloochistan and the Punjab, where the best Indian horses come from. Mule-breeding pays probably better than horse-breeding, for [although it is considered less certain (2 : 3)] the (mule) progeny require less trouble in rearing, and are bought at high price. Every mare suitable for horse-breeding but told off to produce a mule, is a loss to the country, permanently for the former purpose, but only temporarily a gain for the latter. The mule is a working animal and nothing more, the foal is a possible progenitor of future horses. And, moreover, we have seen that the offspring is liable to be influenced by the step sire, so that the mare's value for horse-breeding is permanently damaged. We infer, then, that the use of sound brood mares for mule production is to be greatly discountenanced and not encouraged, and that the best horse-breeding districts are the last which should be encouraged to breed mules. The latter industry is altogether secondary to the former, and should occupy only rejected mares. And yet a careful perusal of the official returns on the subject clearly manifests that, finding mule-breeding more profitable, owners who used to breed horses or ponies are now breeding mules, and possibly in the near future it will be necessary to draw a leaf out of the records of the French Stud Department, which had to adopt measures to *repress* mule-breeding.

I contend that mules should be obtained, when possible, by importation and that there is no objection whatever to *State* stud operations for this industry, if it can be made worth while; but, far from it being promoted in the best horse and pony-breeding countries, it ought to be discouraged there as much as possible, and only mares rejected absolutely for horse sires should be put to Government ass stallions. Experience shows that there is ample field for mule purchasing abroad, and it is probable this would be found less expensive than mule production in this country, but even here there are large tracts of country which might be exploited for mule-breeding. Almost all the Madras Presidency, Lower Bengal, and Burma, which supply no horses and few ponies, might, if judged worth while, be exploited for mules, but the Punjab, Kathiawar, Beloochistan, and the Shan

States are, in my humble opinion, places where the indigenous and flourishing horse-breeding industry should be encouraged by Government as much as is compatible with retention of private zeal in this direction. The Government Department of Horse-Breeding Operations strives to develop to the utmost all the horse-producing resources of the country, recognises that the ways and places of mule-breeding are not those of horse-breeding in the majority of cases, and subordinates in all cases mule-breeding to horse and pony-breeding In many places donkeys are placed for use where the mares are below the horse standard, and in other places where mares are of low class donkeys only are placed ; a man must have his mare branded as *good* enough if he wants to use her for horse-breeding ; but there is, I believe, no regulation under which a mare must be branded as *bad* enough for mule-breeding, surely a necessary precaution where mule foals will sell for more than horse or pony foals !

Fortunately, many a mare unsuitable to ordinary horse duties has qualities which suit her well for mule-breeding. Mules are not used for racing or other fast work, not much for heavy draught, and never to draw guns or mount heavy cavalry. But they are needed for light draught and pack purposes, and for these their flat sides, sluggish temperaments, stolidity, endurance, and power of resisting diseases well suit them. A good mule would be a very bad horse in the majority of cases. Thus many very ugly mares are well suited to throw mule foals, and in mule-breeding the question of unsoundness is not so important as in horse-breeding for it seems that unsoundnesses are not readily transmitted to mule offspring, and, further, we know that they will not, even if they reduce the value of the individual, deteriorate the race.

The qualities of the mule admirably adapt him for his place in life. The French in Algeria, found him very sure-footed, strong of limb, hard of hoof (which does not, like that of the horse, dry up under the influence of heat), with step even and as long as that of the horse, a remarkable power, of ascending and descending steep places and of cleverly turning sharp corners, sure on the worst of roads, quiet, easy to please as regards food, tolerant of heat and thirst, requiring drink less often and less in amount than the horse, more intelligent than we generally consider, and quite susceptible of attachments and amenable to good treatment, they conclude that he is a model animal of transport. He can be ridden, driven, or used for pack purposes; his flesh is edible and not unpleasant to the taste; he will carry small guns and sick men. He gives little trouble over shoeing and may be left unshod, behind especially, for a long time without detriment. He is rather choice in his selection of water, and moist cold weather is unsuited to him; though he exhibits a notable freedom from disease, he suffers severely from some specific affections. He works longer than the horse (5 years of age to 15-20 years), but takes somewhat longer to mature. He inherits the "sobriety, patience, endurance, and sure-footedness of the ass and the vigour, strength, and courage of the horse" (Fleming). Making allowance for size, he carries a weight one-third again as large as that of the horse, so he is essentially a pack animal.

Somewhat of the unjust opprobrium which hangs in Western countries about his progenitor the ass still influences the popular views on the mule. In this age of utility, however, this is being steadily "lived down," and any man who has been on a campaign with a mixed transport of mules, camels, cattle, elephants, and carts will not hesitate to put in a good word for the interesting hybrid to which I have ventured to draw your attention briefly this evening.

NOTES ON THE LARVÆ AND PUPÆ OF SOME OF THE BUTTERFLIES OF THE BOMBAY PRESIDENCY

By J. Davidson, Bo. C.S., and E. H. Aitken.

(*With Plates A, B, and C.*)

Finding ourselves together at the beginning of last rains in a region richer entomologically than any of which either of us had had any experience before, we determined to devote the monsoon months to the study of butterflies, more especially in their infancy and youth. We were successful beyond our wildest hopes. Forest-covered hills were within a mile of our doors, the climate seemed unaccountably favourable to bodily exertion, a rainfall of nearly 200 inches distributed itself so judiciously that it offered little obstruction to whole-day excursions; and, lastly, the season was apparently an unusually good one for larvæ of all kinds. We also had an advantage in the fact that catching butterflies has been for many years common in Karwar, and those Europeans, who were not collectors themselves, far from pointing at us the finger of scorn, used to send us all sorts of flying and creeping things found about their bungalows. Even the cultivators around were accustomed to the sight of "Saheb lok" rushing about their fields and gardens flourishing nets, and did not at once warn us off the premises as has been our experience at home in bygone years. We can never forget our chase after about the first "Clouded-Yellow" we had seen. It was down in Surrey, and after a long chase along the edge of a hay-field we had just got within reach, when we were stopped by three men, the leader of whom promptly stated that he had seen many blank fools in his life, but never such a blank one as our unfortunate selves, and that such blank folly should at any rate not go on in his fields. We humbly apologized, and he turned out a good sort, but alas! that *Colias edusa* never appeared in our collection. Here we had no such experiences, and except one Brahman who deliberately destroyed a creeper in his hedge to prevent us taking leaves to feed some caterpillars of *Parthenos virens*, no instance of churlishness has at any time come to our notice. We determined at first to paint all the butterfly caterpillars we could get, but had very soon to abandon that thought. Finding, feeding and tending took up all our leisure time. We had little reason, however, to regret this, for Mrs. Blathwayt came to our aid with an artistic skill to which we could make no pretence and a naturalist's eye for anatomy and attitude. By the end of the monsoon we found that we had reared nearly seventy species of butterfly larvæ, of which more than half were new to us, and some, as far as we know, have not hitherto been described. We had written careful descriptions and noted peculiarities of habit, and in nearly every case, with the kind help of Mr. W. A. Talbot of the Forest Department, an accomplished botanist, we had identified the food-plant. In the hope of helping others in a most delightful and interesting pursuit and perhaps encouraging some to take it up who have not yet done so, we have agreed to publish our notes. We are fully conscious of their leanness, but cannot help it. Observations begun and ended in one season must be crude, and notes jotted down in the midst of red-tape, fuchsine and foolscap must be arid. But the conditions of life in India are such that, if a thing is not done *now*, it stands little chance of being done at all. We can only ask our readers to "keep kind." With the view, however, of making this paper as complete as we can, we have added a number of species which we have, at some time or other, reared in other parts of India; but we have inserted nothing on the authority of others. Of course, many of the species here described have been described before: but in the first place these descriptions are often not easily available, in the second place caterpillars vary a good deal in different localities and the published descriptions do not always accord with our observations, and in the last place, Indian entomology has not yet got beyond the stage at which cumulative and corroborative evidence is of value.

A few words on the study of larvæ. We wish it were more in favour than it is. It need scarcely be said that the classification of butterflies can never be put on a sound basis without a knowledge of them in all their stages. There are also many curious questions, which puzzle every collector, which can never be answered except by rearing from the egg; the unexplained fact, for example, that the females of some species are so scarce and the males so plentiful. In some cases this is explained, partially at least, by a difference in the habits of the two sexes. In the genera *Charaxes* and *Apatura* the males bask on high trees during the hottest hours of the day, and may always be found by one who knows where to look for them: the females do not bask, and the one who knows where to look for them is yet unborn. But other cases cannot be so explained. Of *Papilio tamilana* last season we caught fifty males and one broken female. Our observations have been too limited to allow us to generalise with safety, but we are inclined to think that in some species many more males than females are produced. Out of a large number of larvæ of *Euthalia lubentina* only a few female butterflies were obtained: in *E. garuda* there was no such disparity. In the case of *P. polymnestor* about two-thirds were males. Experiments on a large scale with one or two species would clear up this point. Then there is the question of broods, which can never be cleared up without rearing. Here again we have not collected sufficient evidence to speak with confidence, but we are satisfied that Mr. Doherty's theory of two wet-season and two dry-season broods is not the rule in this district: we doubt if it is even the exception. In the case of a great many, perhaps the majority, of species, larvæ are found plentifully in June or July, that is, a short time after the monsoon bursts and vegetation starts into growth. These become pupæ, and for a time not a larva is to be seen; then the butterflies of that brood emerge and lay their eggs and larva begin to appear again, but this time they continue for two or three months, in some cases until the end of the year. Then they cease and the butterflies also disappear, but a number of pupæ, and perhaps eggs, remain, to start into life when conditions are again favourable, which will be in March if the food-plant sprouts then, otherwise in June. Of these dormant pupæ a few come out at odd times, but the butterflies thus sent into the world out of season doubtless perish without offspring. This seems to be something like the order of events with many of the common species of *Papilio*, the *Danainæ*, the *Junonias*, and others; but there are many species which do not follow this rule, and some seem to have only one short season in the year. Illustrations will be found in the notes.

A few hints on collecting and keeping caterpillars may be useful to beginners. Lepidopterous larvæ are, with few exceptions, purely herbivorous, and there is scarcely any form of growing vegetation which does not support one species or another, from the tough fronds of the palm to the lichen or moss on its trunk; but one who hunts among leaves promiscuously will not get much for his pains. There are several indications which guide the experienced hunter. The first is "eating:" a freshly eaten leaf soon catches the eye. Unfortunately many things besides butterfly caterpillars eat leaves, but by practice one soon learns to diagnose "eating" with some certainty. For instance, if half a leaf has been eaten in one place and half a leaf in another, it may safely be set down to one of the locust tribe, to which it is a light matter to hop from one branch to another: a caterpillar will eat in one place and will generally be found not far away. If a leaf is riddled with holes we may conclude that a small beetle or lady-bird has been at work: a caterpillar usually eats from the edge. The eating of a full-grown *Sphynx* larva may easily be mistaken for that of a goat; but when hunting for *butterfly* larvæ we are not liable to this error. When the eating is traced to a caterpillar the chances are that it is that of a moth; but if the depredator is found there is not much difficulty in distinguishing the two. Another, more certain, indication of the whereabouts of a caterpillar is its droppings, but these will only be seen on clean ground.

The caterpillars of most butterflies confine themselves to one plant, or to two or three which are closely allied, and even when two very different plants are commonly eaten by the same species, a caterpillar taken on one will usually refuse any of the others. Allied butterflies commonly feed on plants or trees of the same order, and a knowledge of botany, besides guiding the lepidopterist's search, adds very much to the interest of his pursuit. A knowledge of habits will also help the collector. He will soon learn that it is useless to look under a leaf for a *Papilio*, or to look anywhere else for a *Euplœa*. He will also acquire, as a bird-nester does, an instinctive knowledge of likely situations. A butterfly, for instance, will pass over a dozen trees and lay its eggs on a young shoot springing up in the middle of the path. The most valuable discoveries are often made by seeing a butterfly laying its eggs. Nearly all butterflies, unlike moths, lay their eggs singly, on young branches with tender shoots; and so, when you see a butterfly persistently hovering round a tree or bush without flowers, you may guess its purpose. After a time it will alight just long enough to affix one egg, and then fly off again, and if you mark the spot carefully, you may secure the egg.

We are assuming that the collector hunts in person, but a good deal may also be done by the help of natives. At the beginning of last season we used to be accompanied by three or four boys, who carried spare nets, caterpillar boxes, &c. A more unpromising squad can scarcely be conceived—unclothed, unwashed, unintelligent, unambitious, refusing to admit that they could recognise a single tree lest they might be sent to fetch leaves. We always addressed them endearingly as "pigs," and they seemed proud of the name and tried to live up to it. By degrees intelligence dawned. They began to recognise not only leaves, but caterpillars, and to hunt for them. Then the contagion of their example seized the other boys of the town. Droves of "wild pigs" began to come in with insects of all kinds, arousing the jealousy and rage of our own tame pigs. The days were spent in examining and throwing away bushels of crawling things, but in this way we got some of our most valuable caterpillars.

In rearing caterpillars the main point to be kept in mind is that they must have a constant supply of fresh food. If they feed on a leaf which does not wither soon, the task is easy. Any box will do, only it must admit light if the caterpillar is one of those kinds which will not feed in the dark. We reared most of ours in cages with a frame-work of wood and gauze sides. But most leaves, especially in dry weather, must be kept standing in water. In this case, the bottle in which they stand must be carefully plugged with cotton, or else your intelligent caterpillar will walk straight down into the water, expecting to get out at the bottom, and then stay there till it drowns. Many caterpillars will wander from their leaves if they possibly can, and very small ones are easily lost in this way. The best remedy is to keep all minute, or restless, kinds in a bottle, *tightly corked.* Give up all old-fashioned notions about fresh air: there is enough of oxygen in a 2 oz. phial to last a small caterpillar its lifetime. Leaves thus corked up keep fresh for many days, which is a great advantage, for caterpillars dislike being handled, and some kinds, which weave a carpet of silk for their feet, suffer very much in being moved from one leaf to another. The chief dangers to be guarded against in a bottle are damp, dirt, and their consequence, mould. One other precept—caterpillars must on no account be touched when they retire to cast their skins or to change into the chrysalis state. For the rest, the caterpillar fancier's motto must be "Experientia does it."

NYMPHALIDÆ.

Subfamily Danainæ.

The larvæ of this subfamily usually rest on the underside of a leaf, seeking no protection, and are for the most part conspicuously coloured. They feed generally, if not always, on plants having a milky juice, such as those of the orders *Asclepiadeacæ* and *Apocynaceæ.*

1. *Danais chrysippus*, Linnæus.

This familiar larva will be found carefully described in Marshall and de Nicéville's book. In Canara it is comparatively rare, at least on the coast; but everywhere else in the Presidency it may be found at almost any time of the year on the common "Madar" (*Callotropis*): we have got it on nothing else.

2. *D. aglœa*, Cramer.

We found this at Lanowlie in October feeding on *Tylophora carnosa* and met with it again in the same month at Karwar. It is a beautiful larva, of the usual *Danais* form, with only two pairs of filaments, of a rich brown or claret colour, with a pair of round yellow spots on each segment, and between these numerous, much smaller, bluish-white spots; on the sides the spots are gathered into a conspicuous longitudinal stripe just above the legs; the under parts are black. The pupa is of the usual form and of a greenish-yellow colour, with gold spots and beaded ring; but probably it varies much.

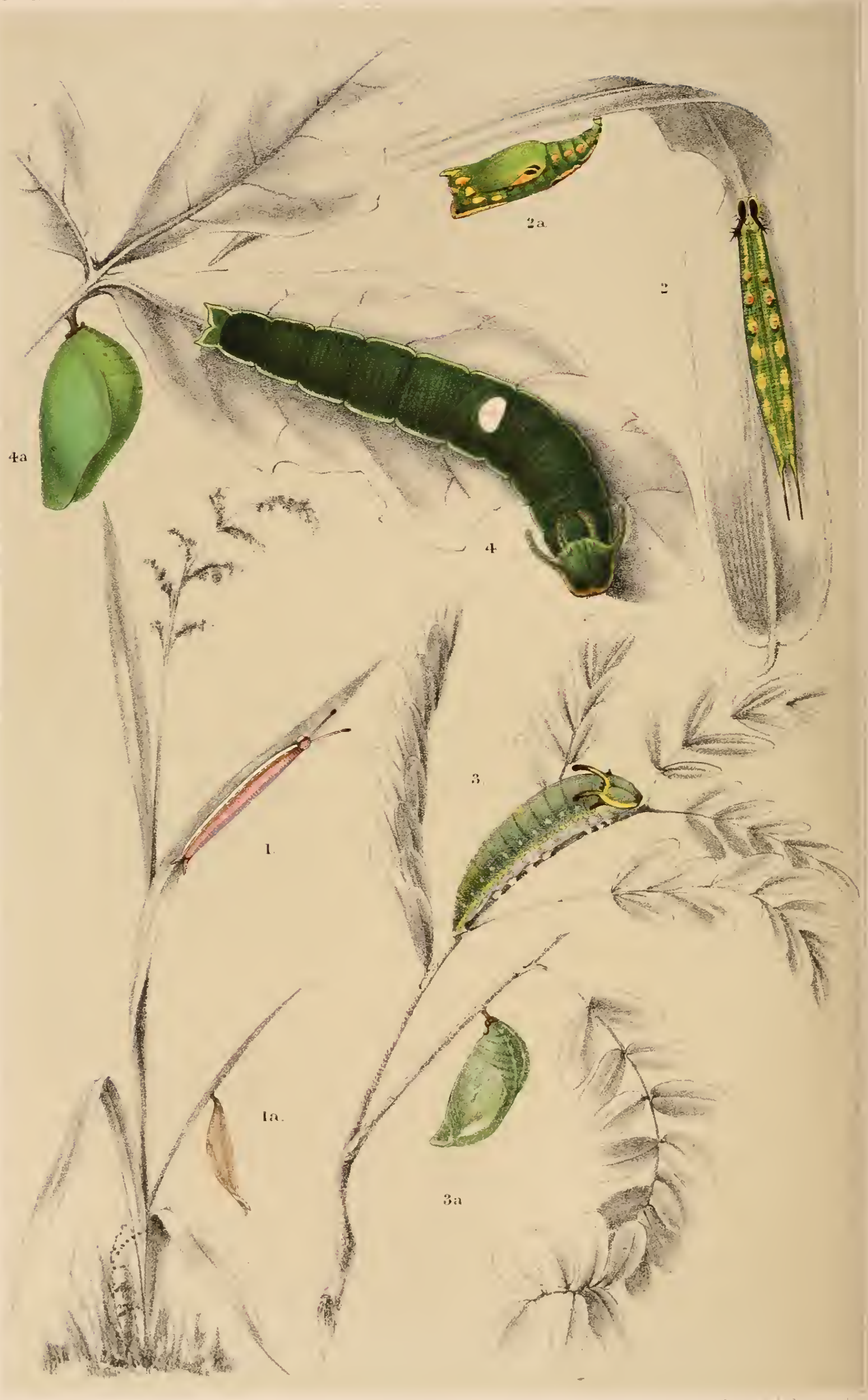
Note.—In Marshall and de Nicéville's book this species appears under the name *D. grammica.*

3. *D. limniace*, Cramer.

This also was found at Lanowlie in October, feeding on a wild species of wax-plant (*Hoya viridiflora*). We reared it in Karwar on a different plant in June. It was very abundant in that month, then seemed to disappear for two months, when it reappeared in smaller numbers. The larva and pupa have been described by Messrs. Marshall and de Nicéville. (Since these notes were written Mr. de Nicéville has examined some of our specimens, and considers them nearer to *D. septentrionis* than *D. limniace.* Will not Mr. Moore or somebody discriminate the Canara form? *D. limnitrionis* would be a good name!)

4. *Euplœa core*, Cramer.

This larva also has been accurately described by Messrs. Marshall and de Nicéville. To their description of the pupa we may add that its colour is very variable, the commonest hue in this Presidency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being that of burnished silver, or sometimes gold, with or without broad black lines defining the wing-cases. The larva may be found at almost any season, feeding in gardens on oleander and in the jungle on different species of *Ficus* and other trees; but never have we seen it in such numbers as in Karwar in June 1889. It almost amounted to a plague. During the following month it disappeared, but was found again from August onward.

Subfamily Satyrinæ.

5. *Mycalesis mandata*, Moore. Plate A, Figs. 1, 1*a*.

We got one specimen, feeding on grass, in September. The larva is spindle-shaped, transversely rugose and rough, owing to the skin being clothed with minute bristles. There are two long setose spines on the head, pointed forwards, and two caudal spines. The colour above is rosy red, with a blue dorsal line and a white lateral line, below which the under parts are green. The pupa is perpendicularly suspended, slender, and regular, except that the head-case is produced into a long beak formed of two thin processes like split straws. In colour it is whitish-brown with faint striæ of a darker shade. It has very much the look of a large grain of barley.

6. *Mycalesis mineus*, Linnæus.

Larva spindle-shaped; head larger than neck and surmounted with two short protuberances; last segment elongated and ending in two fine points: colour some shade of brown with a lateral dark line, sometimes indistinct, formed by a chain of minute cruciform marks. This colour is assumed when the larva is half-grown: at first it is green with a black head. Pupa oval, without angle or irregularity of any kind, very like that of *Melanitis*, but proportionally thicker; light green with a pale line across the wing cases. We got one specimen on rice, in July, and a dozen the following June from eggs laid by the unocellated form in captivity. Mr. de Nicéville has described and figured the transformations of this species.

7. *Melanitis leda*, Linnæus.

Larva long, slender, spindle-shaped, rough; two short caudal processes; head large and armed with two erect, straight horns, which are thickly set with minute spines or bristles; colour grass green, with a yellow lateral line and many rows of very small white spots; head normally green, with the horns and a continuing cheek-stripe red, and three black spots on the face, but sometimes the head and horns are dark brown with three white spots on the face. The pupa is regular, quite smooth, and of a pale watery green colour without markings.

In Guzerat and Bombay we have reared this on grass. In Karwar we found it during August and September on rice. It is very shy, resting by day on the underside of a blade and feeding by night.

Subfamily ELYMNIINÆ.

8. *Elymnias caudata,* Butler. Plate A, Figs. 2, 2*a*.

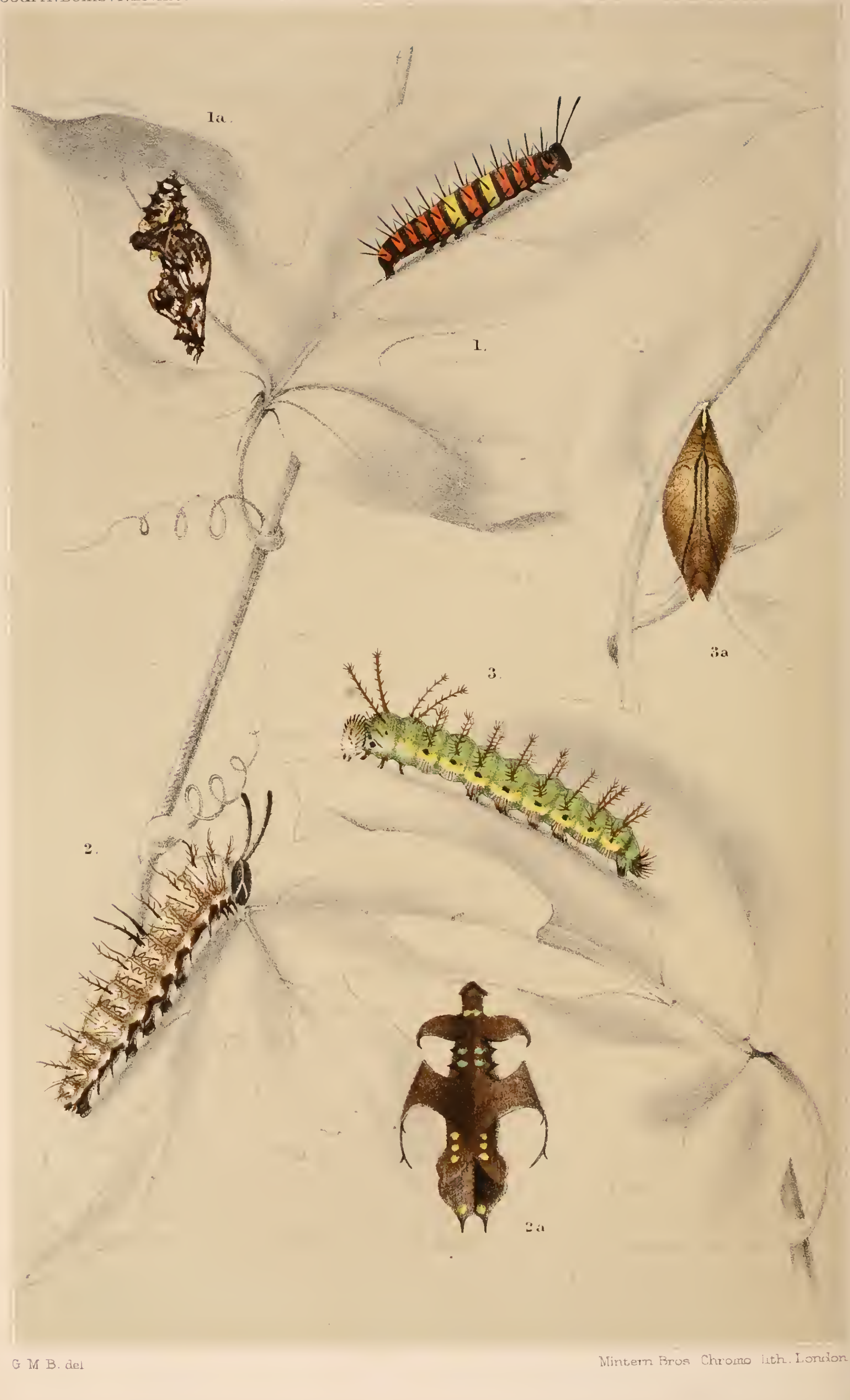
Larva spindle-shaped, slender, transversely rugose and clothed with short, stout bristles, just visible to the naked eye; head large, surmounted by two stout, straight horns, sloping backwards, slightly branched at the ends; a pair of long, straight, caudal spines, setose like the body; colour bright green, with longitudinal yellow lines, more or less distinct, and two rows of large yellow spots tinged with pink and sometimes tipped with black on the back; head dark brown, with a yellow cheek-stripe and frontal line. Pupa suspended by the tail only, but in a rigidly horizontal position; regular with the exception of two small pointed processes from the head and an acute thoracic projection above them; colour bright green, beautifully ornamented with four irregular rows of large yellow spots bordered with red.

We got two larvæ and several pupæ on the cocoa-nut and betel-nut palms in October, but they must have been out from July or August.

Subfamily ACRÆINÆ.

9. *Telchinia violæ,* Fabricius.

Larva cylindrical, slender, with six longitudinal rows of fine branched spines; colour reddish-brown with an oily gloss, much paler on the head, second and last segment; an unwholesome looking insect, doubtless protected like the butterfly. Pupa perpendicularly hung, long, slender, smooth; two lateral angles on the thorax, head quadrate, colour creamy-white with broad longitudinal bars of pur-



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plish-black spotted with orange. We found this plentifully in July, August, and September on the wild Passion-flower (*Modecca palmata*).

Subfamily Nymphalinæ.

10. *Ergolis ariadne*, Linnæus. Plate C.

Larva cylindrical, slender; two dorsal rows of sharp spines with three or four fine branch spines springing from a point in the middle of each; two rows of similar but shorter spines on each side; one pair of long, strong, and straight spines on the head irregularly set with small spines which cluster at the end; colour variable, sometimes green with longitudinal dark brown lines, or dark brown with an interrupted, broad, dorsal stripe of pure white, not extending to either end. Pupa slender, wing-cases somewhat dilated, a dorsal protuberance, and two small cephalic points; colour variable; rigidly attached by the tail, so that, if the surface is vertical, the pupa stands out horizontally. We reared this in Guzerat on *Tragia cannabina* and in Karwar on *Tragia involucrata* in June and August. Both plants sting like nettles. The larva is a restless little creature and moves its head from side to side when walking.

11. *Ergolis taprobana*, Westwood.

We got specimens of this among the last, but could not distinguish either the larvæ or the pupæ.

12. *Byblia ilithyia*, Drury.

We know of only one specimen of this butterfly having been caught in Canara. In Khandeish and the Deccan we have reared the larva along with those of the last species on *Tragia cannabina*. We were able to distinguish them only by the fact that the light dorsal line was continued the whole length of the body in this species and was comparatively uninterrupted. The pupa was undistinguishable.

13. *Atella phalantha*, Drury.

We have reared this in Guzerat, Mahableshwar, and Karwar in March, May, June and November. The description of the larva quoted from Mr. Moore by Messrs. Marshall and de Nicéville does not correspond with the specimens we have reared. It is cylindrical, moderately thick, very smooth, with an oily gloss, and bears six longitudinal rows of sharp branched spines. The head is unarmed. The colour varies from dark brown to pale yellowish-green, with a white or yellowish spot at the base of each spine. It feeds on one or more species of *Flacourtia.* The beautiful pupa has been accurately described by Mr. de Nicéville, and it is only necessary to add that the colour is very variable, some specimens being almost white and some bright green; the markings are usually silver-edged, or tipped with red. It hangs by the tail, but in a horizontal position.

14. *Cupha placida*, Moore.

Among the larvæ of *Atella phalantha* which we reared in June, several, which we did not distinguish until they became pupæ, produced this butterfly. It is not improbable that we should have found some distinguishing points if we had looked for them, but we are disposed to think that the differences even in the imago of the two species scarcely justify generic separation. The pupa can be distinguished at once by a double row of long and slender filaments springing from the principal tubercles.

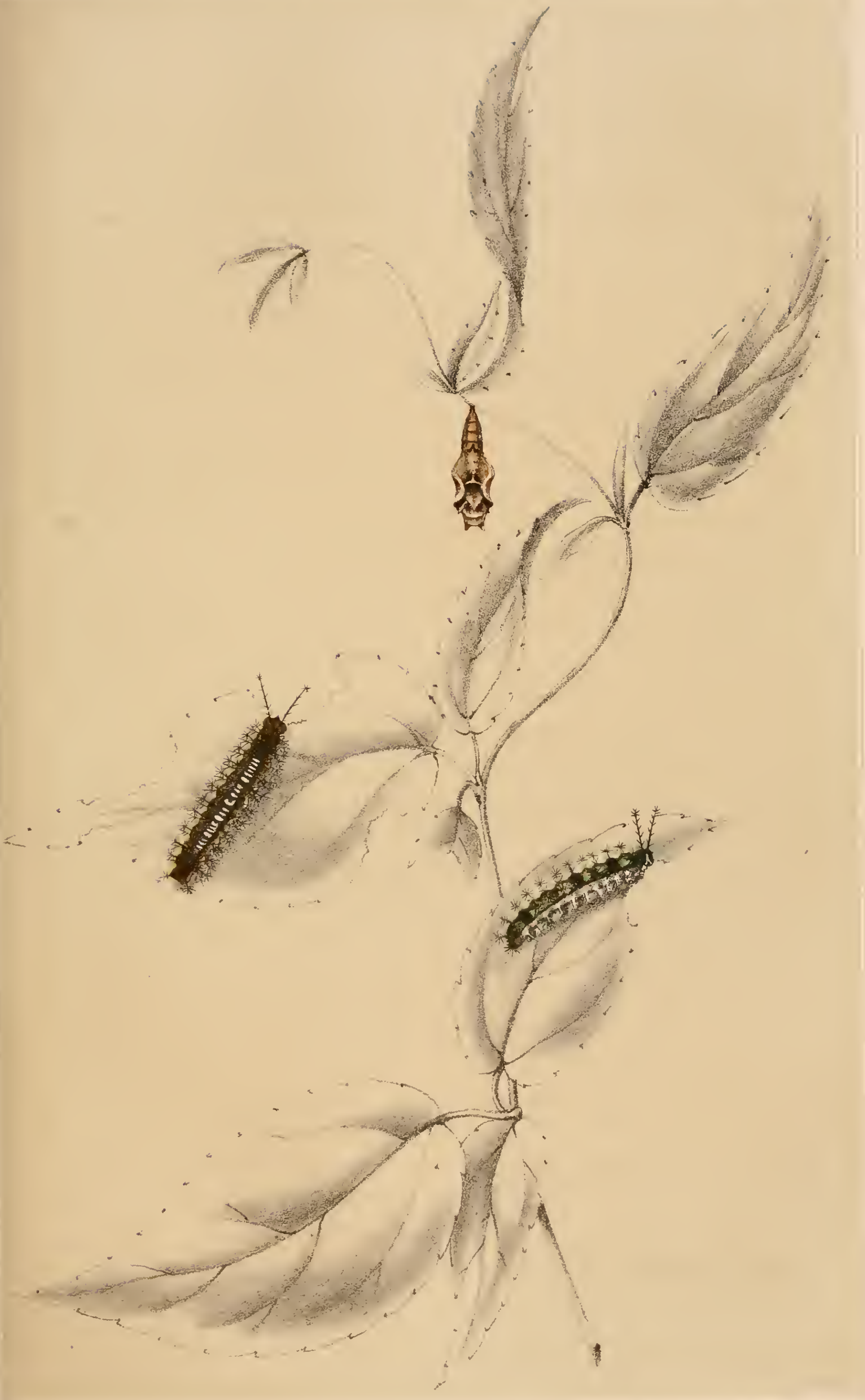
15. *Cethosia mahratta*, Moore. Plate B, Figs. 1, 1*a*.

Larva cylindrical, but much constricted between each pair of segments and tapering somewhat towards the head. Six longitudinal rows of fine, pointed spines: on the head only one pair of longer, blunt spines. Colour dark brown, with bright red bands encircling all the segments except the 1st, 2nd, 6th and 8th: on the 6th and 8th the red is replaced by broader bands of lemon yellow. Pupa hanging vertically, slender, with two large, foliaceous processes springing from the middle of the back and many less prominent processes and tubercles on the head, thorax and abdomen: colour purplish-brown, much mottled with lighter and darker shades: six dorsal spots of bright gold. We got this first in June and July and then very plentifully in October, on the wild Passion-flower (*Modecca palmata*). The caterpillar is gregarious all through its life. The pupa, when touched, vibrates in a manner well calculated to deter the hungriest enemy.

16. *Cynthia saloma*, Swinhoe. Plate B, Figs. 2, 2*a*.

Larva cylindrical, head armed with two large, curved, spiny horns, Journ. Bomb. Nat. Hist. Soc. 1890. Vol. V

Plate C



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the body with six rows of well branched spines: colour pale yellow, lightly marbled with dark brown; head black with an inverted V of yellow; under parts black. Pupa very grotesque; two extraordinary expansions, like bat's wings, springing from the basal abdominal segment, a smaller pair on the penultimate segment, and a large angular, dorsal prominence above the head: colour light, or dark brown, with two rows of subdorsal silver spots on the thorax and three pairs of green spots on the abdominal segments. This larva was found on the same plant as the last species about the end of September, but must have been plentiful earlier, as the butterfly came out about the beginning of July, and was common enough all through the rains. It is a night-feeder, retiring to some distance often to another plant, during the day.

17. *Apatura camiba*, Moore.

Larva long, slender, thickest in the middle; head small, armed with two long, straight, much branched spines, pointed forward: a pair of smooth caudal spines. Colour pale yellow on the back, with a medial row of green spots; green on the sides with a narrow yellow line; head and horns black. Pupa compressed, with a high, pointed, dorsal prominence at the junction of thorax and abdomen, from which a sharp ridge runs to the tail; suspended by the tail, but curving round to an almost horizontal position; pale green. We got this in September, October and November on a species of *Celtis*. It has much the aspect of the caterpillars of the *Satyrinæ* and appears to have similar habits, resting by day on the underside of a leaf, and feeding by night.

18. *Precis iphita*, Cramer.

As regards the form, one description will serve for the larvæ of the whole *Junonia* group, to which this belongs. They are cylindrical, slightly pubescent, and armed with nine longitudinal rows of many branched spines, except on the head, which is clothed with short bristles. They feed, as a rule, on *Acanthaceæ*. The pupa is regular, with three, or five, dorsal rows of small tubercular points, hung perpendicularly.

In the larva of *P. iphita* the spines seem to be shorter and more closely set than in the *Junonias*. The colour is dark, dull brown.

It feeds on "Karvee" (*Strobilanthus*), and doubtless occurs more or less throughout the year. We found few, for though the butterfly is the commonest in Karwar, the plant is still commoner, an unfavourable condition for the caterpillar hunter. The pupa is smoky brown.

19. *Junonia asterie*, Linnæus.

Larva reddish-brown, with the spines lighter. Pupa light brown, marked with lighter shades. We found this at Karwar in June, July and October without ascertaining its food plant. In Bombay we have reared it on *Lippia nodiflora*, and once, in company with the next, on *Asteracantha longifolia*.

20. *Junonia almana*, Linnæus.

We have reared this in Bombay on *Asteracantha longifolia*, a prickly plant, with blue or purple flowers, which grows in wet ditches everywhere during the monsoon and withers soon after. The butterfly appears in October, a little later than the last. We kept no description of larva or pupa.

21. *Junonia lemonias*, Linnæus.

We have reared this in Bombay on *Barleria prionitis*, a prickly mud plant, like *A. longifolia*, but with yellow flowers, but kept no description. We have found it also in many parts of the Deccan during the rains.

22. *Junonia hierta*, Fabricius.

We have reared this in the Deccan and Khandeish, and found many at Karwar last October on a plant which appeared to be a species of *Barleria*. The ground-colour was usually dark brown, or grey, with a broad dorsal stripe formed by minute white and blue spots; spines black.

23. *Junonia orithyia*, Linnæus.

The larva is minutely described in Marshall and de Nicéville's book. We have found it in the Deccan at the end of the rains climbing up tall stems of grass early in the morning, and did not ascertain its food.

24. *Neptis hordonia*, Stoll.

We found last September a pupa from which the butterfly had just that moment emerged. It was inclosed in a cluster of the withered leaves of *Cæsalpinia mimosioides*, and the circumstances left little doubt that that was the food plant.

25. *Neptis jumbah*, Moore.

The larva is correctly described by Moore, as quoted by Marshall and de Nicéville. It is a most promiscuous feeder. We found it on *Helicteres isora*, *Grewia microcos*, *Zizyphus rugosa* and several other plants, from August to October.

The pupa is suspended vertically, slender in the abdominal part, with a sharp dorsal ridge, much stouter and broader in the thoracic region, with wing-cases expanded laterally; two sharp points on the head; colour varying from dark brown to dull white, suffused and touched at points with gold.

26. *Cirrhochroa thais*, Fabricius.

"Larva with two dorsal series of long, and two lateral series of shorter, delicately branched spines, also a similar spine projecting on each side in front of the head from the second segment."—Marshall and de Nicéville. In colour the many we found were uniformly black, with an oily gloss, excepting the head and last segment, which were light brown. The pupa was almost white on the wing cases, yellow elsewhere, with numerous minute black spots, suspended in a horizontal position, bearing two dorsal series of recurved spines and pairs of similar, but longer, spines springing from the margins of the wing-cases, the thorax and the head.

We found these in July, August and September on a common tree, *Hydrocarpus wightiana*. Though the tree was usually surrounded by butterflies laying eggs, it was often difficult to get larvæ. They appeared to resort to the topmost, tender shoots, and dropped to the ground on the least alarm. In captivity they were very troublesome, running about incessantly in indecent haste and often refusing to eat. Many, moreover, were destroyed by a small ichneumon.

Some of the specimens we reared have been identified by Mr. de Nicéville as his own *C. relata*, and others were intermediate. We are satisfied that they are not separable.

27. *Hipolymnas bolina*, Linnæus.

Larva cylindrical, armed with nine longitudinal rows of fine branched spines: a single pair of longer and stouter spines on the head. Colour very dark, rich brown; head light brown. Pupa dark, earthy brown, mottled with a lighter shade; somewhat angular about the head and thorax; abdominal segments armed with dorsal rows of short, sharp tubercles.

We have reared this in Guzerat in October and in Karwar during July and August. They were generally found on the ground, so the food plant was not ascertained; but they fed readily on a minute weed called by botanists *Elatostemma cuneatum*, and some ate, while others refused, *Portulacca oleracea*, the ordinary food of the next species. All we reared were of the small dark form. The large form (*avia* or *jacintha*) was common enough, but we did not get it from larvæ.

28. *Hipolymnas misippus*, Linnæus.

Not a specimen of this was seen in Karwar until September, when it suddenly became very common; but we got no larvæ. In Bombay and the Deccan we have often found it at the end of the rains on *Portulacca oleracea*, commonly cultivated as a pot herb by natives, and known, of course, as *Bhajee*.

29. *Parthenos virens*, Moore. Plate B, Figs. 3, 3*a*.

The following description by Moore of the larva of the nearly allied *P. cyaneus* of Ceylon will answer for the form of this species:—"Cylindrical, head and anal segment spined, other segments slightly hairy, third to twelfth segments armed with branched spines, which are longest on third, fourth, eleventh, and twelfth segments." For the colour we may refer readers to the beautiful drawing by Mrs. Blathwaite. We got only a few of these in September and October, and had difficulty in rearing them owing to the scarcity, in the vicinity of Karwar, of its food, a creeping plant with large, thick, elliptic leaves. The pupa is boat-shaped and of a uniform fine brown colour, suspended perpendicularly.

30. *Limenitis procris*, Cramer.

We found this from July to October on *Mussoenda frondosa*, a plant easily recognisable by the white leaves at the ends of the flowering branches, which make it a most conspicuous ornament of the jungles. Of all the larvæ we reared this is in every respect one of the most remarkable. When young it is slender, cylindrical, evenly clothed with short spinous tubercles and of a uniform dark brown colour. It remains on one leaf, eating it regularly back from the point, but leaving the midrib, and as it eats it fringes the eaten margin with its excrement, held together by silk, among which it is absolutely undistinguishable. After the last moult it abandons these strange habits and lives openly on the upper side of a leaf, having changed its form for one in which it is able apparently to despise concealment. Its head is now very large and closely set with short, stout, simple spines: on the back there is a double row of strong spines, or sharp tubercles, clustered at the ends of short stems; on the third segment there are two pairs, more laterally situated, of processes similar to those on the back, but three times as long, and on the fourth segment one pair longer still. The colour is still dark brown. The pupa is also dark brown, suspended vertically; abdominal part slender, with small dorsal tubercles, thoracic part much stouter, wing-cases much dilated laterally; head produced into two foliaceous, hammer-shaped processes, which meet at the ends, leaving a circular hole in the middle. The pupa easily passes for a small withered and twisted leaf.

31. *Athyma perius*, Linnæus.

This is not at all a common species in Kanara, but very abundant everywhere on the hills further north, where we reared it in March on *Glochidion lanceolatum*. The larva and pupa are described and figured by Marshall and de Nicéville.

32. *Euthalia garuda*, Moore.

This is by far the commonest *Euthalia* in this Presidency as elsewhere. Its strange larva has so often been described and figured, that we need not describe it again; but the nature of the protection which its curious form affords it seems to us to be as totally misunderstood as it could be when we are told to suppose that it mimics some species of the *Myriapoda*. One who has reared any considerable number of *E. garuda*, *lepidea*, or especially *lubentina*, and when changing their food, morning after morning, has thrown away half his stock after carefully examining every leaf, will be forced to find a truer explanation than that. The caterpillar, which eats little and grows slowly, spends most of its time at rest, motionless, on the upper side of a leaf of precisely the same tint as itself. A dorsal line, or row of spots, however it may look on paper, succeeds in keeping up the continuity of the midrib of the leaf in a way which cheats the sharpest eye, while the long interlaced spines, extending on each side, fall in with the neuration. In *E. garuda* the dorsal line is light yellow, touched with blue, and the spines are fringed with yellow. The pupa hangs by the tail on the underside of a leaf, often the very one on which it spent its larval life, for it is too cautious an insect to eat the leaf it lives on. *E. garuda* commonly feeds on the mango and the cashewnut tree, but we have found it on the mulberry and the rose, and on *Loranthus* along with the next species. The first brood of larvæ was found about the end of June, and the butterfly swarmed in July. About a month later larvæ became very plentiful again and so continued until we went into camp in the beginning of November, and had to give up keeping them. They certainly lasted till December.

33. *Euthalia lubentina*, Cramer.

This was found in August, September and October on two common species of the so-called "Mistletoe" (*Loranthus*). It probably continued till the end of the year. In form the larva resembles the last; in colour it is grass-green, but the dorsal area of most of the segments, between the spines, is brown or claret-coloured, with or without a pure white diamond in the middle. The spines are tipped with the same shade of brown, and it is worthy of note that the leaves of *Loranthus* are often disfigured with spots or patches of this tint. The pupa is green with a small brown patch on each side: it wants the gilt edging of *E. garuda*, and the dorsal triangle is more sharply pointed. For lovers of the marvellous it may be worth mentioning that the caterpillar of *E. lubentina*, when it has cast its skin, spines and all, *eats it*.

34. *Euthalia lepidea*, Butler.

Larva of the usual *Euthalia* form; colour green, with a dorsal row of light red ocelli with blue centres; spines tipped with yellow. Pupa more narrowed at the head than *E. garuda;* green, all the points golden yellow tipped with black, and a few large spots of gold between. It is a beautiful pupa. We found this very abundantly all the latter half of the monsoon on *Melastoma malabathricum,* a shrub with large and handsome flowers, sometimes called Rhododendron.

35. *Euthalia evelina,* Stoll.

We got one pupa of this. It was green, but had the dorsal triangle edged with silver, and silver spots on the sides corresponding to the gold markings of *E. lepidea.*

36. *Pyrameis cardui,* Linnæus.

This is too well known to need many words. An interesting account of the habits of the larva in America, quoted by Marshall and de Nicéville, holds equally true in this country. We found it in Canara in November, and have reared it often in Bombay and the Deccan, always on the same thing, a kind of thistle of the genus *Blumea,* with strongly aromatic leaves.

37. *Kallima horsfieldii,* Kollar.

Larva cylindrical, finely pubescent, armed with nine longitudinal rows of fine branched spines; head surmounted with two long straight horns set with minute spines; colour a beautiful golden brown, spines red, head black. We found one specimen of this in July on Karvee (*Strobilanthus*), and after careful examination, discovering nothing except its colour to distinguish it from *H. bolina,* decided that it must be a larva of the large form which has been separated under the name of *H. avia.* The likeness of the pupa to that of *bolina* was still more exact, and the emergence of a beautiful *Kallima* took us completely by surprise.

Note.—We have called this *K. horsfieldii* because we are unable to believe in the specific distinctness of *K. wardi.*

38. *Charaxes athamas,* Drury.

"Larva elongated, thickest in the middle, dark green; head large, wide, flattened and surmounted by four spinous processes; last segment with short, naked points; the segments with an oblique yellowish white stripe, most prominent on the 7th, 9th, and 11th segments; beneath these a lateral series of small white spots." This is Mr. Moore's description and is good, but we have found different specimens to vary very much in the distinctness and colour of the lateral stripes: they are always present, but sometimes very faint indeed. Another more importantpoint, which seems hitherto to have escaped notice, is that the last pair of legs are almost obsolete, and are not used in walking.

We found this from June to October on the "Goolmohr" (*Poinciana regia*), the "Khairee" (*Cæsalpinia mimosioides*) and several other trees. The larva, like those of most wary and strong-winged butterflies, is very shy and cautious in its habits, feeding by night and remaining motionless all day; but it is much preyed on from the time it leaves the egg, and only a small proportion seem to reach maturity. The pupa is almost oval, smooth, and without irregularities; in colour green, with faint white lines more or less distinct.

39. *Charaxes fabius*, Linnæus. Plate A, Figs. 3, 3*a*.

We found a few in Karwar in July and August, and have also reared it in Khandeish and the Deccan, always on the tamarind tree. The larva differs from that of *C. athamas* in having the outer pair of horns longer than the inner, while in *C. athamas* the reverse is the case. The colour is bluish-green, with a small semicircle of white in the middle of the back. The pupa is like that of *C. athamas*, but uniformly green.

40. *Charaxes imna*, Butler. Plate A, Figs. 4, 4*a*.

Larva of the usual form, head very broad, outer pair of horns longest, last segment flat, square, and ending in two points; last pair of legs almost aborted; colour rich, dark green, with a large semicircle of pinkish-white in the middle of the back and a yellow lateral line; horns and sides of face rusty brown. We reared three specimens of this on *Aglaia roxburghiana*, a very common tree in Canara, belonging to the order *Meliaceæ*. Among butterflies the length of the larval life seems to be generally proportional to the robustness of the insect in its perfect state, and, as might be expected, *C. imna* is a Methuselah among butterflies. One found on the 6th of October, then evidently a few days old, became a pupa on the 25th of November. The butterfly emerged on the 9th of December.

Like most smooth caterpillars, this species eats its skin when cast, but not the head-case. When touched it appears to use its horns defensively, as does also *C. athamas*.

Note.—The figure represents the larva and pupa of a fine female, exactly natural size.

(*To be continued.*)

THE BUTTERFLIES OF THE CENTRAL PROVINCES

By J. A. Betham.

Part III.

(Continued from Volume V., page 161.)

27. *Junonia asterie*, Linnæus (344). This and the next in Mr. de Nicéville's book are, I am persuaded, one and the same butterfly. It heads the genus *Junonia* of Hübner, all of which, except perhaps *J. atlites*, are of a sprightly nature with a rapid flight. It is a bright rust-red butterfly with brilliant peacock spots on both wings. It looks something like the English "Peacock" butterfly, paled by a residence in a hot climate! It is found in glades and gardens by the margins of streams and about tanks, and looks very handsome as it sits and fans its wings in the sunshine.

28. *Junonia almana*, Linnæus (345). There is very little difference between this and the last butterfly on a casual examination; but if looked at closer, it will be seen that the shape of the wings is somewhat different, the hindwing being more tailed and the forewing more falcate. The markings on the underside are less prominent, the ocelli have almost entirely disappeared, and the white bar or fascia across the hindwing of *J. asterie* is scarcely perceptible. *J. asterie* is commoner in the wet season, while *J. almana* predominates in the dry season.

29. *Junonia atlites*, Linnæus (346). This is the largest species of the genus,—at least in these parts,—and is always found in and about marshy spots, on the borders of streams and damp places generally. It is a pale grey butterfly, the wings appearing somewhat transparent; it has some small "peacock" spots on both wings. The flight is distinctly slower than any of its relatives, so that there is no difficulty in capturing it.

30. *Junonia lemonias*, Linnæus (347). This is the commonest species of the genus, and is found almost everywhere. It is a dusky-brown insect with yellowish and black markings and similar "peacock" spots on both wings as has *J. atlites*. The underside varies considerably in many specimens, it is generally of a pale clay colour, but often is almost brown and frequently reddish or pink. I have a specimen in which the ground-colour of the hind-wing is clear claret

colour. It is fond of hedges and ditches, and is a very sprightly and pugnacious little creature.

31. Junonia hierta, Fabricius (349). This species has been known as *J. œnone,* but Mr. de Nicéville points out that the latter name belongs to an African insect which was known as *J. clelia.* It is a beautiful little insect with its bright yellow and blue markings. The female lacks the blue, and is somewhat larger than the male. This butterfly and the next may be seen resting in the middle of the most exposed parts of roads and paths, and rising in front of one, it skims swifty along and settles again on the road perhaps after a battle in the air with one of its own kind or *J. lemonias, J. asterie* or *J. orithyia ;* all of which have the same habit and love the full and hot sunshine.

32. Junonia orithyia, Linnæus (350). This is a dark blue butterfly of similar habits to the two last mentioned. They all love the hot sunshine, and this and the last are to be found in the most open and exposed situations; open grass plains being about the most favourite spots. It has a brilliant blue spot like the last on the hindwing, but whereas the prevailing colour of *J. hierta* is yellow, in *J. orithyia* it is blue. The larva of all the *Junoniæ* are dark in colour with numerous branched spines all over them : gruesome creatures to look at, but perfectly harmless. The females lay their eggs on or near the ground.

33. Neptis hordonia, Stoll (352). As far as I can judge, this and the next *N. plagiosa,* Moore (353), are one and the same species. There is very little difference between them, and the gradations from the one to the other form are very gradual. The markings are disposed in bands, which are black alternating with tawny. The flight of the butterflies of this genus is peculiar. They seem to float and sail along, so that when on a level with the eye they disappear and re-appear ; when settled on leaves as is their habit, they rest with wide expanded wings.

34. Neptis varmona, Moore (379). This and *N. kamarupa,* Moore (384), with *N. eurymene,* Butler (385), are only, there is little doubt, varieties, or better, seasonal forms, of one and the same species. The chief difference is in the depth of colour in the yellow of the markings of the underside, which varies from a pale yellow to a colour that is almost brown. *N. swinhoei*, Butler (383), of which I have specimens, is merely another variety of *N. varmona*. This genus is closely imitated by many of the genus *Athyma*, and one or two of the genus *Apatura* in the disposition of the black and white band-like markings above, in the similarly disposed yellow or brown and white markings below, and in the manner of flight and habit. *N. varmona* and its varieties are very common and easily captured. The body, when fresh, has a beautiful sheen, especially upon the thorax, which appears green or gold as the light happens to strike it.

35. *Neptis nandina*, Moore (397). Easily distinguished from the foregoing by the chocolate colour of the markings on the underside. It is perhaps a larger insect, but has the same habits and flight, so that it is not easy to detect the difference until it has been captured in the net.

36. *Neptis ophiana*, Moore (400). This is a much larger insect than any of the others mentioned, and the white colour on the upperside of the wings has a greenish tinge, especially in worn specimens.

37. *Neptis jumbah*, Moore (402). Something like *N. nandina* in appearance, but the markings are differently disposed, and it has a small brown spot near the base on the underside of the hindwing on a white band, so that once caught, it can be easily distinguished from all other *Neptis*.

38. *Hypolimnas bolina*, Linnæus (419). This is a lovely insect, one of the most gorgeous of the many exquisite living gems this land of India produces. The ground of the wings on the upperside surpasses the texture and depth of the finest deep blue velvet, while from the middle of each wing blazes a spot which is white surrounded by blue in some specimens; while in others, there is no white visible, and the deep rich blue flashes out only in certain lights : such is the colouring of the male. The female is usually larger and duller in appearance, resembling *Euplœa core*, and no doubt mimicing that well-known insect. It is a fairly large butterfly, but there are two seasonal forms,—the smaller appearing after the hot weather and the beginning of the rains, the larger at the end of the rains. The sight of this beautiful creature, as it opens and closes its wings while basking in the sun, affords a brilliant spectacle, especially, as is very often the case, when there are several seated within reasonable distance of

one another. The male displays itself to the female in a striking manner. The latter, while flying from one place of concealment to another (for it is a shy creature as compared to the male), is usually pursued by one or two males who fly a foot or so below her, quivering their wings to the full extent of their powers. This is evidently done with the object of displaying their loveliness to the greatest advantage.

39. Hypolimnas misippus, Linnæus (420). The male of this butterfly resembles that form of the male of the last species which appears during the rains or at the close of the hot weather, though, as a rule, it is much smaller. It is a pugnacious little insect, and has a rapid flight. The female is very much larger, and at first sight appears to belong to quite another sub-family, for it is a close mimic of that common butterfly *Danais chrysippus*, and not only mimics the common form, but the more uncommon ones which are known as *D. alcippus* and *D. dorippus*. *D. alcippus*, has a patch of white on the hind-wing, and *D. dorippus* has the black patch at the apex of the fore-wing, and the white macular band inside it more or less obsolescent, so that the real ground-colour pervades the whole wings more than it does in typical *D. chrysippus*. The female of *H. misippus* mimics these two uncommon forms exactly, but is commoner in these forms than the type it mimics! Both the common form which mimics *D. chrysippus* and the less common form which mimics *D. dorippus*, I have reared from eggs laid by one and the same female, which was herself of the *D. dorippus* type! I watched her as she laid her eggs and succeeded in securing four, three of which hatched, and produced spiny looking black caterpillars, very much like those of *Junonia*. They fed on *Portulacca quadrifida*, a common weed, fond of garden paths. One of the caterpillars received an injury just when it was turning into a chrysalis from the boy who was attending them, pulling it down from where it hung by the tail. He evidently could not understand why it should assume such an uncomfortable position. Just when it should have emerged and the colours and markings (which were of a female of the common type) were visible it succumbed. The other two came out all right and proved to be also females; but one was of the common or *D. chrysippus* type, while the other resembled the *D. dorippus* type, and had the white macular band faintly visible.

They were sacrificed to the cause of science and adorn my cabinet,—examples of a most interesting case in which two different types were produced from one parent. The eggs were laid on the 16th October, and were hatched in three or four days. The larvæ turned to chrysalides on the 7th and 8th Nov. and emerged on the 19th and 20th November. The remarks by Colonel Swinhoe in Vol. I., page 169 *et seq.* on the mimicry displayed by this butterfly, are most interesting and well worth perusal. The flight of the female of *H. misippus* very much resembles that of *D. chrysippus*, and, indeed, it is very difficult to tell which is which until they settle, when they can readily be distinguished by the black spots in the centre of the hind wing. *D. chrysippus* has three small black spots disposed about the cell, whereas the female of *H. misippus* has only one large one.

40. *Argynnis niphe*, Linnæus (421). This is a regular "Fritillary" as regards the general colouring of the male, but the female is a more or less close imitation of *Danais genutia*, and in flight looks very like the butterfly it mimics. The male has all the characteristics of the typical "Fritillary," dashing about in flight, and fanning its wings when settled just in the same sharp manner as do the "Fritillaries" at home. It has some blue marks on the margin of the hind-wing, upperside, which serve to distinguish it from others of the same genus. Underneath, the base of the wings is rosy, and it has green and silvery markings like its English relatives.

41. *Limenitis procris*, Cramer (452). This is a very beautiful creature allied to the "White Admiral," and has an elegant sailing flight. It is fond of forests, and settles on the leaves of trees with widely-expanded wings. The colours black, brown, and white are similarly disposed as are those of the "White Admiral," *Limenitis sibylla*. Below the chief colour is a delicate and pale grey. Some specimens are very much paler than others, and the black markings are replaced by brown; those markings which are ordinarily brown being paler in these instances.

42. *Athyma perius*, Linnæus (454). This also resembles the "White Admiral," but its flight is not quite the same. In this respect it is almost undistinguishable from the black and white *Neptes*, which it also closely resembles in the colour and disposition of its markings, and which are placed in broad bands of black and white.

43. *Symphædra nais*, Forster (478). This sprightly little butterfly looks something like a "Fritillary" in colour, but the red is deeper It has a quick and jerky flight, something like that of the *Junoniæ.* Its habits are very much the same as *J. orithyia* and *J. lemonias* and it is very fond of "sugar" and mhowa refuse.

44. *Euthalia lepidea*, Butler (498). I have only met with this species in Káláhandi, where it seems fairly common. It has a very rapid flight and is very wary, though it can be caught by baiting with Mhowa refuse. Its colour is a dark brown with a grey border to the wings.

45. *Euthalia garuda*, Moore (513). This is a dark brown butterfly with a few darker markings and whitish spots on the forewing of the male and some larger white spots on the forewing of the female. It is a very pugnacious creature, but readily comes to Mhowa refuse. I have caught many and watched more on the margins of tanks close to the water where they descend towards the middle of the day to suck up the moisture. The caterpillar is a most extraordinary looking creature, and bears long branching interlacing lateral spines. Though such a queer-looking object and so remarkable, it is difficult to see when seated in the middle of a leaf, because it is of a green colour and the spines look just like the veins of the leaf. It is a common butterfly. The proboscis or *haustellum* of the butterfly is green.

46. *Euthalia lubentina*, Cramer (517). A darker brown butterfly than the last which it resembles in shape. The underside has numerous markings of a rich scarlet, and it can easily be recognised by this feature. It is fond of carrion, and a friend of mine informed me that he once took one seated on a piece of meat in the Crawford Market, Bombay City.

47. *Pyrameis cardui*, Linnæus (520). This is the most ubiquitous of butterflies being found all over the globe except in the Arctic regions and S. America—our well-known and much-admired friend the "Painted Lady,"—and surely one of the most lovely of all butterflies, with its rich and varied hues on the upper and tender greys, browns, and rose on the underside.

48. *Kallima inachis*, Boisduval (551). This is the great "leaf-butterfly,"—one of the most marvellous instances of protective resemblance in nature. The upperside is deep rich blue with an orange

patch on the forewing, the underside is as exact an imitation of a dead leaf as could be made. The mid-rib, the veins, the stem formed by the lobe of the hindwing, and the point of the leaf, formed by the apex of the forewing being produced, are all there. It is mottled all over with blotches and little splashes just as if the leaf was covered with lichen or decay. In the forewing there are two clear spots, in each wing, which coincide when the wings are closed, as is invariably the case when the insect is at rest, and actually represent holes in the leaf! Each butterfly is differently coloured on the underside, and in a good collection you come across every variety of russets, browns, greys, and faded yellows showing, as Mr. de Nicéville remarks, "a wonderful series of autumnal tints." When the insect is seated on the ground or on a tree, it is very difficult to suppose that it can be anything than a leaf, and it is not until it is disturbed that one realises that it is endowed with active life and powers of motion. I have never tried it with Mhowa, but fancy it would come to it readily enough. I came across it in Pachmarhi, and found it fairly common down in the khuds and ravines about that charming little sanitarium.

49. *Charaxes athamas*, Drury (568). The fastest flying butterfly I have come across. Its colours are black and yellow or pale green, the pale colour disposed in a band extending from the point of the forewing to the hinder angle of the hindwing. The colours underneath are exquisite, with a sort of silvery sheen about them. It is, in common with *C. fabius* and *C. imna*, a very foul feeder.

50. *Charaxes fabius*, Fabricius (570). The colour of this insect is a blackish-brown with yellow spots placed in a band across both wings. It is a bold creature with a strong flight, but sometimes falls a prey to curiosity. One settled on my boot once, and another time another wanted to see what my tonga was and flitted round it, as it went along, until it was caught.

51. *Charaxes imna*, Butler (577). This is truly a beautiful creature. The colours are a deep rich chestnut with a velvetty black border in the male, relieved in the female by a broad white band across the forewing. It has the most powerful flight of any butterfly I know, (while *C. athamas* has the fastest) and looks like a bird while on the wing. The female is larger than the male and much more

conspicuous, because of the broad white band aforesaid. It is, however, a very foul feeder and greedily fond of mhowa, so much so, that it can be approached and taken by the fingers while engaged in its meal. One year I took several of these and *C. fabius* and a few *C. athamas*, at a Sirris tree, *Acacia speciosa*, which had a bough injured in some way, and from which a juice exuded. Several other kinds of insects, chiefly ants and flies, were attracted by this juice, and a number of the small green bee-eater, *Merops viridis*, the magpie robin, *Copsychus salauris*, and the king crow or drongo shrike, *Buchanga atra*, were attracted by the insects. The wings of several of the *Charaxes* that I took had bits clipped out of them by the beaks of the birds. Toddy is also a good bait for butterflies, after it has fermented a little. I was induced to try it after seeing the attraction the Sirris juice had, and I found it very successful.

FAMILY 2, LEMONIIDÆ.

SUB-FAMILY 2, NEMEOBIINÆ.

52. *Abisara suffusa*, Moore (614). A sprightly little creature, very bold and not easily frightened. It hops and skips about the leaves in a jerky, merry sort of way. Its colour is a reddish-brown with a few paler bars across its wings.

NOTES ON THE ECONOMIC BOTANY OF THE CUCURBITACEÆ OF WESTERN INDIA.

By Dr. W. Dymock.

(*Read at the Society's Meeting on 7th July 1890.*)

Of the seventy-one species belonging to this Order, described in the "Flora of British India," thirty are found in Western India; and as the time of year for observing these plants is now approaching, a few remarks upon their properties and economic uses may not be without interest. The genus is divided by botanists into three tribes, viz., *Cucumerineæ, Orthospermeæ* and *Zanoniæ;* in the first, the ovules are almost always horizontal as in the cucumber; in the second, they are erect; and in the third, pendulous. All the plants which I have to notice, with one exception (*Zanonia*), belong to the first tribe.

The genus Trichosanthes (*thrix*, a hair, and *anthos*, a flower) are easily distinguished by their prettily-fringed flowers. Five plants belonging to it are known in Western India: *T. palmata*, *T. dioica*, *T. nervifolia*, *T. cucumerina*, and *T. anguina*; the last is the well-known snake-gourd (*Parul*, Marathi; *Padval*, Guzerathi), so much used as a vegetable by Europeans and Natives. It may be cooked in various ways: Europeans usually prefer it sliced and boiled, so as to resemble a dish of French beans; prepared in this way it has a very delicate flavour, and retains its bright green colour, except in the cold season, when the addition of a little soda to the water is necessary: it is also cut in short lengths and stuffed with minced meat. The natives usually slice it and prepare it with onions and spices; cooked in this way it forms a very tasty dish, to which meat may be added.

T. cucumerina (the *Rán-parul* or *Kadu-parul*, common on hedges on Malabar Hill), appears to be the wild form of the snake-gourd; the flowers are similar, but the fruit is only a few inches in length. The whole plant is extremely bitter and purgative like colocynth; it is collected, dried, and sold in the bazars as the representative of the drug called in Sanskrit *Patola*. The Portuguese have named it *Sabina* (Savine), and the Dutch *Kalpert*.

T. dioica is not a native of the Konkan, but in Guzerat it occurs in two forms—the wild or *Kudva-padval* and the cultivated or sweet variety. The first is used throughout Northern India, Bengal, and Guzerat as the representative of the *Patola* or *Patolaka* of Sanskrit writers, which is so named from its fruit having the shape of a "mussel shell." This resemblance is sufficiently obvious, the fruit being from two to three inches long, oblong, acute, and frequently slightly curved. In medicinal properties it resembles *T. cucumerina*. The cultivated variety is a favourite vegetable in Bengal, Northern India, and Guzerat; it is free from bitterness, the small fruits are stuffed with spices and fried or curried, and the young shoots are dressed as greens. I have tried to grow the plant from Bengal seed, but it does not flourish in the red soil of Malabar Hill.

T. palmata is a large climbing plant with woody stems, often as thick as a man's arm, which grows on hilly ground in the Konkan, and is common at Mahableshwar; it is the *Mahakala* of Sanskrit writers, who describe it as a kind of gourd with an exterior resembling an orange, but with pulp like cowdung. *Mahakala* is also a name of Ganesha, the god of wisdom, the causer and remover of obstacles, the son of Siva and Parvati; and this gourd is used as an ear ornament (*Kundala*) for the figure of Ganesha or Ganpati, which is dressed up and seated in state in every Hindoo house once a year. At this season large quantities of the fruit are brought for sale to Bombay. The fruit is also medicinal, and is smoked as a remedy for asthma; when burnt it gives off large quantities of ammonia. It also contains a bitter purgative principle somewhat similar to that of colocynth. The Marathi name is *Karandal*. The green pulp in the interior of the fruit contains a colouring matter, which has more of the red in its florescence than chlorophyll, and its spectrum shows a different arrangement of bands than is seen in the usual green colouring matter of plants. My friend, Mr. Hooper of Ootacamund, sent some of it to Professor Michie Smith, and with several other colouring matters it forms the subject of an interesting paper read by him before the Royal Society of Edinburgh.

T. nervifolia is a large climber with cordate strongly-nerved leaves and ovate fruit. As far as I know, it is not used in any way in this part of India.

Lagenaria vulgaris is the bottle-gourd; it occurs in two forms—wild and cultivated. The former is known as *Alabu* in Sanskrit, and the latter as *Kadutumbi*. In Bombay we call the cultivated variety *Safed Dudhiya* or *Dudhiya Bhopala*. It is a much esteemed vegetable, and is best cooked as a curry, cut in small pieces after the country fashion. Served like vegetable marrow on toast, it is insipid, but a capital imitation of mashed turnips may be made from it with the assistance of the fruit of *Momordica Charantia* (*Karela* or *Karala*) to communicate the necessary bitterness. Both of these gourds are obtainable at all seasons of the year. The bitter bottle-gourds (in Marathi *Kadutumbi*) has the purgative properties of colocynth. It grows to a very large size, and may be seen in use all over India as a bottle or jar for holding fluids. Very large gourds of this species are imported from Zanzibar, and are much valued for making the Indian guitar or *Tambura*; they take a fine polish like close-grained wood.

Of the three species of Luffa found in Western India, *L. ægyptiaca* and *L. acutangula* are valuable vegetables; the vernacular names *Ghosali*, *Turai*, *Sirola* and *Dorki* are applied to both plants, but the former is distinguished as *Ghi-turai*, *Gilchi-dorki*, *Gilchi-ghosali* (on account of its superior richness), and *Matti-ghosali* in the south, on account of its habit of climbing over trees, which it adorns with its large yellow flowers far into the cold weather. In Sanskrit *Koshataki* is a general name for this genus: it is derived from *Kosha* "the cocoon of a silk-worm," and alludes to the way in which the seeds are enclosed within a fibrous network. The Sanskrit names *Ghoshaka* and *Dalika* appear more particularly to appertain to *L. acutangula*. The two species of Turai are easily distinguished; the fruit of *L. ægyptiaca* being smooth and that of *L. acutangula* marked with ten prominent, sharp, longitudinal ridges. As vegetables these gourds may be cooked in various ways like the snake-gourd, which has been already noticed; but they are best cut in transverse slices, dipped in a cream composed of warm spices and gram flour, and fried in butter or olive oil. The sliced fruit may also be added with advantage to fish omelettes.

The fibrous network contained in the ripe fruit of *L. ægyptiaca* is used in India as a strainer, and is sold by European chemists and druggists as a skin-rubber. A wild form of *L. acutangula* common on hedges has been named *L. amara*; it is very bitter, and has medicinal properties similar to those of colocynth. It is known as *Kadu-dorki* or *Kadu-ghosali*.

L. echinata, in Sanskrit *Devadali*, in Marathi *Deodangri* "fairy's gourd" and in Guzerathi *Vapala-bij* (a name derived from the Sanskrit *Vapa*, "weaving," in allusion to the cocoon-like network in which the seeds are enclosed), is used medicinally. It contains a highly poisonous principle similar to, if not identical with, *Colocynthitin* ·0296 grain of which administered to a cat proved fatal in four hours and twenty-five minutes; it also contains *Colocynthin* the bitter purgative principle of colocynth. The dangerous nature of this gourd was brought to notice a few years ago by Dr. Kirtikar, when a servant of his died with symptoms resembling those of cholera after taking a decoction of a single fruit as a purgative. The fruit is about the size of a small nutmeg and thickly set with long soft spines.

Benincasa cerifera (in Sanskrit *Kushmanda*, in Marathi *Kohola*), bears a large pale green gourd, which has a great reputation among the Hindus; when ripe it is covered with a waxy white bloom, and is thought to possess valuable medicinal properties, and to be a specific for spitting of blood and other internal hæmorrhages. The fruit should be at least a year old before it is used for making the medicinal confection known as *Khanda Kushmandaka*. The pulp is scraped out and the watery juice, which exudes during the process, is preserved; the pulp is then boiled in its own juice, strained and dried in the sun; it is then fried in *ghi* and again boiled in the juice which was strained from it, until reduced to the consistence of honey. Sugar, spices and honey are now added over a gentle fire, and the confection, after being well stirred, is fit for use. The dose is from one to two tolas. This gourd is also used as a vegetable like *Lagenaria*, and the pulp, after being boiled, is mixed with flour and molasses and made into small lumps (*Vati*, Sanskrit; *Vadi*, Marathi) and fried in *ghi* or oil; they are considered to be highly nutritive.

Of the four species of Momordica which occur in Western India, none are used by Europeans, but *M. Charantia* and *M. dioica* are used as vegetables by the Natives. The first is the muricated fruit like a crocodile's back called *Karala* in Marathi; it is very bitter, but wholesome, and requires to be steeped in salt and water before it is cooked. It tastes best when cut in transverse slices, dipped in a cream made of spices and gram flour, and fried in butter. The Sanskrit name is *Karavella*, and the gourd bears the synonym *Kandira* or "armed with arrows." I have already shown how it may be utilized in combination with the bottle-gourd in European cookery.

The softly spinous fruit of *M. dioica* (in Marathi *Kartoli* or *Karantoli*; and in Sanskrit *Vahasa* or *Karkotaka*), when cultivated loses its bitterness, and is in common use as a vegetable; it is dressed like *M. Charantia*, and is by no means to be despised. The fruit of the wild plant is bitter, and its tuberous roots, which are not bitter, are used medicinally in bowel complaints; and in the Konkan their juice is a domestic remedy for the inflammation caused by contact with the house lizard. The root of the female plant, which often weighs a pound or more, is of a yellowish colour, and somewhat like a turnip in shape; it contains an alkaloid which is not purgative.

M. cochinsinensis occurs in the Deccan and South Konkan; it is called in Sanskrit *Karkataka* from the resemblance of the sculptured seeds, which are flat and rather more than half an inch in diameter, to the shell of a crab (*Karka*). In the vernaculars it is known as *Kakrol.* The seeds, after the shell has been removed, are fried and eaten alone or with other food; they are considered to be good for cough and pains in the chest; powdered they form one of the ingredients of the hot stuff known as Jhál in Bengal, which, mixed with *ghi*, is given to women after confinement for a few days, and is supposed to remove phlegmatic humours.

M. Cymbalaria, in Marathi *Kadavanchi*, is a small delicate climbing plant with tuberous roots about the size of a wallnut or less; these tubers have been several times sent to the Chemical Analyser's Office in Bombay, as having been used to procure abortion; they contain a bitter glucoside, and a very acrid resin, and are highly poisonous.

Cucumis trigonus occurs in two forms; the smooth-fruited variety (in Marathi *Kátrel* or *Kárit*), has a very bitter fruit about the size of a small egg. At the time of the Deváli large quantities of this fruit are brought for sale to Bombay; they are crushed beneath the foot after the ceremonial bath early in the morning on the Naraka Chaturdasi, or first day of the Deváli, and the bitter juice applied to the tongue,—a practice which appears to resemble that of eating Nimb leaves on the Varsha-pratipada or New Year's Day. This custom is peculiar to the Konkan, and I am informed by Dr. Bhandarkar, is unknown in the Deccan. The fruit is considered to be medicinal, and, when pounded or boiled with cow's milk and applied to the head, is supposed to prevent insanity, strengthen the memory, and remove vertigo; it contains the same purgative principle as colocynth. The other form of *C. trigonus* appears to be a semi-cultivated one; it is pubescent, and in the unripe state is used as a vegetable, when quite ripe it becomes sweet and tastes like a melon. This gourd is called *Takmaki* in Marathi, and is common towards the end of the rains in gardens and cultivated fields.

Cucumis Melo is the true melon; it is the Batikh of Egypt which was so much regretted by the Jews in the wilderness; it was cultivated by the Greeks and Romans. The melons of Bokhara and Persia are famous; the Emperor Baber is said to have shed tears over a melon of Turkistan which was sent to him in India. The Arabs, who also call it *Batikh*, believe that it is one of the fruits of Paradise. We do not meet with melons of this quality in India, but a variety, *utilissimus*, much like a cucumber, is cultivated all over the country, it is called *Tavashi* in Marathi.

C. sativus is the true cucumber; as this fruit is so well known, it is hardly necessary to say more about it, but I may remark that the finest flavored cucumbers in the Konkan are those grown upon hilly ground; the cucumbers of Malabar Hill, for instance, are much esteemed in Bombay. To fully appreciate the flavour of a cucumber it should be eaten young with salt and pepper only.

The genus Citrullus affords us the bitter, purgative colocynth fruit, so common on the plains of the Deccan—in Sanskrit *Indravaruni* and *Vishala*, and in Marathi *Kururundavan*; but from this very unpromising source have been obtained by cultivation the water-melon, *Citrullus vulgaris* (in Marathi *Kalingad*), and the excellent vegetable known as Dilpasand, which, when young and fresh, is little inferior to the vegetable marrow. Of the water-melon we have a sweet and a bitter kind; the latter is the *Citrullus amarus* of authors, and has much of the properties of the parent colocynth. There are many cultivated varieties of the sweet water-melon; those grown about Bombay are much inferior to the produce of hot and dry climates, such as the coast of the Persian Gulf, where a slice of this fruit, after a few minutes' exposure to the hot air of the Garmásir, is a luxury equal to the most delicious water ice. This melon is the *Batikh-el-Hind* or "Indian melon" of the Arabs and the *Hinduwanah* of the Persians.

Cucurbita maxima is the common gourd; *C. moschata*, the musk melon; and *C. Pepo*, the pumpkin. These gourds are all cultivated in India. *C. maxima* is said to be a native of the Levant, and often attains to an enormous size, 240 lbs. are on record; it is the *Potiron* of the French and the *Lál Dudhiya*, *Támarabhopala* or *Dhángar* of the Marathis *C. Pepo*, which bears the same Indian names, is said to be a native of Astrachan, and the vegetable marrow, *C. ovifera*, is considered by some to be a variety of it introduced from Persia. *C. moschata* is our *Chibur* or musk-melon.

The common gourd and the pumpkin are most valuable vegetables; the latter is much used in India by both Europeans and Natives: it yields an excellent soup, and mashed with milk or cream a vegetable dish which is always procurable. Pies are also made with it. The natives of India dress gourds in various ways as a vegetable curry; they also make small pellets (*vadi*) of the pulp with flour and molasses, which they fry in oil or butter, and use the young shoots of *C. maxima* as greens. This use of the shoots is mentioned by Pliny, but appears to be now unknown in Europe; they taste much like turnip tops. The musk-melon is very inferior as a fruit to the true melons.

Amongst the Ancients, pumpkins, melons, and cucumbers were considered to be emblematic of abundance and fertility, on account of the numerous seeds contained in them, and from their having the form of a belly without head or limbs; they were also thought to represent sensuality and stupidity. In Italy a fat stupid man is still called "zucca, zuccone, citrullo; and the French are fond of applying the terms "concombre" and "melon" to such people. The Marathas have got hold of the same notion, as they use the term "Bhopalasuti" in the sense of gross, stupid, &c.; again "Bhopoladeota" signifies a tomboy or hoyden—and "Bhopaliya-rog," Tony Lumpkin's consumption—dying of fat.

Cephalandra indica, in its wild state, grows on every old wall on Malabar Hill; the fruit is bitter, oblong, and about two inches in length. When ripe, it is of a bright scarlet colour. In Sanskrit it is called *Vimba* and *Tundika*, and in Mahratti *Tondali*. Indian beauties are described by poets and story-tellers as Vimboshta, "red or cherry lipped." The cultivated plant has rather larger fruit, which is free from bitterness, and when unripe, is a favourite vegetable with the natives. The leaves afford a deep green and perfectly harmless colouring matter, and the root is used medicinally.

The remaining plants belonging to this order are all medicinal, and contain principles similar to, if not identical with, *bryonin*, a bitter principle found in the European Bryonys. *Bryonia laciniosa* is the *Baja* of Sanskrit writers, and is said to have been used in

Vedic times to frighten away evil spirits; it is still known in Hindi as *Bajguriya* or "Baja beads." Another name for it is *Ghargunaru*, which signifies a string of ankle bells, such as are worn by dancing girls. These bells have vertical slits in them, resembling the white vertical stripes on the globular fruit of this plant. In Marathi it is called *Karale-che-dole*, "crow's eyes." Towards the end of the rains it is common on hedges, and may be found on Malabar Hill. The fruit is about the size of a marble, red when ripe, with dead white vertical stripes. The Dutch, according to Rheede, call it *Slitten*, and the Portuguese *Nhola*. *Mukia scabrella* is a very similar plant, but with fruit about the size of a pea and marked in the same manner. It is called *Chirati* in Marathi. The Sanskrit name *Ghantali* (*Ghanta-áli*, a row of bells) appears to be applied to both of these plants, as well as the name *Ahilekhana*, "marked like a snake."

Zehneria umbellata (in Marathi *Gometta*) is also a very common plant on hedges, with oval red fruit about the size of a pigeon's egg. The tubers are used medicinally by the natives as an ingredient in Paushtiks, "strengthening confections." The Dutch call this gourd *Karlingen*, and the Portuguese *Pepinho do pata*, "Goose's cucumber." The tubers of *Rhyncocarpa fœtida* are used in the same way; it may be distinguished by its ovoid, rostrate fruit.

Corallocarpus epigæa and *C. conocarpa* much resemble one another, with slender climbing stems, lobed leaves, very small flowers, and beaked fruit. The root is an enormous tuber, sometimes weighing as much as five or six pounds, and shaped like a turnip. It is medicinal, and is sold in the Bombay bazars under the Guzerathi name of *Kadvi-nai*. These plants are called *Sivalinga* and *Mahadera* in Marathi,* and in Sanskrit, *Chhilihinda*, *Patala-garuda* and *Mahamula* or "great root."

Zanonia indica is only found in the Southern Konkan. It has a curiously-shaped fruit like a candle extinguisher, which the Portuguese call *Fruita bandoliera* from its resemblance to the leather cases called bandoleers each containing a charge of powder of which every musketeer wore twelve suspended by a shoulder belt. The Dutch name is *Naet-klim*. In Sanskrit and Marathi it is called *Chirpota*, and is used medicinally.

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* In allusion to the form of the fruit

The seeds of the Cucurbitaceæ, when freed from their husks, afford a bland edible oil; even those of the colocynth are eaten in time of scarcity. They contain 48 per cent. of fatty oil, 18 per cent. of albuminous substances, besides a small quantity of sugar. The seeds of the cucumber, melon, water-melon, and bottle-gourd or pumpkin were called by the Ancients "the four cold cucurbitaceous seeds," and were considered to be cooling, diuretic, ard strengthening. These four cold seeds are still sold in Indian bazars decorticated ready for use.

The *oleoresin* of pumpkin seeds obtained by exhausting the powdered seeds with ether is a thick red liquid, which is given in doses of one to three table-spoonsful as an anthelmintic; it must not be confounded with the expressed oil, which is inert.

LIST OF CHIN-LUSHAI BUTTERFLIES.

By Lionel de Niceville.

Below will be found a list of the butterflies collected by Lieut. D. Thomson, of the 28th Pioneers, in Chin-Lushai country during the expedition in the cold weather of 1889-90. The specimens have been presented to the Bombay Natural History Society.

Family NYMPHALIDÆ.

Sub-family Danainæ.

1. *Danais tytia*, Gray.
2. ,, *septentrionis*, Butler.
3. ,, *chrysippus*, Linnæus.
4. ,, *genutia*, Cramer.
5. *Euplœa rhadamanthus*, Fabricius
6. ,, *midamus*, Linnæus.
7. ,, *alcathoë*, Godart.

Sub-family Satyrinæ.

8. *Mycalesis sanatana*, Moore.
9. ,, *mineus*, Linnæus.

10. *Lethe sinorix*, Hewitson.
11. ,, *dyrta*, Felder.
12. ,, *vindhya*, Felder.
13. ,, *mekara*, Moore.
14. *Ypthima philomela*, Johanssen.

Sub-family MORPHINÆ.

15. *Enispe euthymius*, Doubleday.

Sub-family NYMPHALINÆ.

16. *Ergolis merione*, Cramer.
17. *Euripus halitherses*, Doubleday and Hewitson.
18. *Cethosia cyane*, Drury.
19. ,, *biblis*, Drury.
20. *Cynthia erota*, Fabricius.
21. *Apatura namouna*, Doubleday.
22. ,, *parysatis*, Westwood.
23. *Hestina nama*, Doubleday.
24. *Precis iphita*, Cramer.
25. *Junonia atlites*, Linnæus.
26. ,, *lemonias*, Linnæus.
27. ,, *hierta*, Fabricius.
28. *Neptis kamarupa*, Moore.
29. ,, *soma*, Moore.
30. ,, *ophiana*, Moore.
31. ,, *nandina*, Moore.
32. *Cirrhochroa mithila*, Moore.
33. *Pseudergolis wedah*, Kollar.
34. *Stibochiona nicea*, Gray.
35. *Parthenos gambrisius*, Fabricius.
36. *Limenitis daraxa*, Doubleday and Hewitson.
37. ,, *procris*, Cramer.
38. *Athyma selenophora*, Kollar.
39. ,, *cama*, Moore.
40. *Euthalia franciæ*, Gray.
41. ,, *lepidea*, Butler.
42. ,, *appiades*, Ménétriés.
43. *Symbrenthia hippoclus*, Cramer.

44. *Symbrenthia hypselis*, Godart.
45. *Cyrestis thyodamas*, Boisduval.
46. ,, *risa*, Doubleday and Hewitson.
47. *Kallima inachis*, Boisduval.
48. *Doleschallia polibete*, Cramer.
49. *Charaxes athamas*, Drury.
50. ,, *aristogiton*, Felder.
51. ,, *pleistoanax*, Felder.

Family LEMONIIDÆ.

Sub-family Libythæinæ.

52. *Libythea lepita*, Moore.

Sub-family Nemeobiinæ.

53. *Zemeros flegyas*, Cramer.
54. *Abisara neophron*, Hewitson.

Family LYCÆNIDÆ.

55. *Pithecops hylax*, Fabricius.
56. *Cyaniris marginata*, deNicéville.
57. *Curetis bulis*, Doubleday and Hewitson.
58. *Ilerda epicles*, Godart.
59. *Rapala xenophon*, Fabricius.
60. *Polyommatus bœticus*, Linnæus.

Family PAPILIONIDÆ.

Sub-family Pierinæ.

61. *Hebomoia glaucippe*, Linnæus.
62. *Prioneris thestylis*, Boisduval.
63. *Appias hippoides*, Moore.
64. *Terias hecabe*, Linnæus.
65. *Ixias pyrene*, Linnæus.
66. *Hiposcritia indra*, Moore.
67. *Catopsilia crocale*, Cramer.
68. *Huphina nama*, Moore.
69. *Mancipium canidia*, Sparrman.

Sub-family Papilioninæ.

70. *Leptocircus meges*, Zinken-Sommer.
71. *Papilio dasarada*, Moore.

72. *Papilio ganesa*, Doubleday.
73. ,, *paris*, Linnæus.
74. ,, *castor*, Westwood.
75. ,, *antiphates*, Cramer.
76. ,, *dissimilis*, Linnæus.
77. ,, *protenor*, Cramer.
78. ,, *rhetenor*, Westwood.
79. ,, *philoxenus*, Gray.
80. ,, *sarpedon*, Linnæus.
81. ,, *aristolochiæ*, Fabricius.
82. ,, *mahadeva*, Moore.
83. ,, *macareus*, Godart.

Family HESPERIIDÆ.

84. *Badamia exclamationis*, Fabricius.

BOOK NOTICES.

THE BUTTERFLIES OF INDIA, BURMA AND CEYLON.

The third volume of *The Butterflies of India, Burma and Ceylon*, dealing with the Lycænidæ, bears only the name of Mr. de Nicéville, Major G. F. L. Marshall having been forced, by official work and bad health, to retire from the work. This volume, however, fully keeps up the character for unsparing thoroughness established by the first. It is difficult to recall another book on any branch of Natural History so absolutely complete. Indeed, if there is any fault to be found with the book, it is that it is too cumbrous. It might have been reduced in volume, without loss of usefulness, by leaving out much that has been inserted about the numberless pseudo-species which have been made out of every butterfly subject to much variation. No penalty attaches to the description of a new species, and it is an easy road to a kind of distinction which is dear to some men, so that descriptions, under new names, of mere casual, or seasonal, varieties are rashly given to the world, and the lepidopterist finds his time less occupied with exploring the history and ways of butterflies than the errors and absurdities of men. That Mr. de Nicéville, before he could write his book, should have to work his way through tons of rubbish was inevitable; but it scarcely seems necessary that he should take his readers with him. Take, for example, the genus *Curetis*. Agreeing with Hewitson, Mr. de Nicéville believes that there are but two species, *bulis* and *thetys*, nevertheless he describes thirteen, seven of which have Mr. Moore for their godfather. The question is not whether Mr. Moore or Mr. de Nicéville is right: both may be wrong. But Mr. de Nicéville is an author, not merely an editor, and his task is to exercise his judgment and give us the result. If, for the sake of leaving out nothing, he felt himself obliged to notice the eleven species in which he did not believe, he might have relegated them to the region of small type foot-notes, or dismissed them with a reference to the journals in which the original descriptions might be found. However, he has always stated his own opinion clearly, and the fact that he has, in deference to the opinions of older entomologists, given a place to descriptions of supposed species, in the distinctness of which he could not himself believe, tends to disarm criticism. No serious attempt can be made, in this brief notice of the book, to judge between Mr. de Nicéville and those from whom he differs; but it is safe to say that a great many even of the species which he retains must go sooner or later (probably sooner). Under the genus *Amblypodia*, for example, he gives descriptions of seven species, himself believing in only two; and as we glance over these seven descriptions, we notice that in every one the underside is described definitely, as if it was always the same in each species. Now any one who has lived among butterflies of this genus knows that they are as variable on the underside as *Kallima*: no two are alike. It is charitable to suppose that Mr. Moore and Mr. Grose Smith did not know this when they floated new species on the strength of single specimens not even sexed; but those who do will naturally regard the seven species of *Amblypodia* with suspicion.

Next to its completeness its accuracy is the most remarkable feature of this book. When the number of references and scientific names, and the opportunity which these afford to the "printer's devil" are considered, the correctness of the text seems simply marvellous. It is matter for pride that such printing can be done in India, but of course every word of the proofs must have been corrected by Mr. de Nicéville himself, or some competent entomologist. The illustrations, too, are as good as any we have seen, the coloured plates by Messrs. West, Newman and Co. being particularly lifelike. In many respects this volume testifies to the advance which has been made in our knowledge of Indian butterflies since the former volumes appeared. The notes on habits, distribution, &c., seem in every respect more complete and trustworthy, and many will be surprised at the number of species of which Mr. de Nicéville is able to give a complete life history. Some of these histories are very interesting and well fitted to stimulate further research. The *Lycænidæ*, though small, are in many respects the most fascinating of all butterflies, and we may confidently predict that this volume will give a great impulse to the study of them. Much remains to be done. Since this volume was in print, *Thaduka multicaudata*, an extremely rare species, found hitherto only in Burma, has been caught in Canara. All the specimens caught before were females, and the Canara specimen was of the same sex, so the male remains to be discovered. In conclusion we note that Mr. de Nicéville hopes to bring out the next volume on the *Pieridæ*, in much less time than was needed for the *Lycænidæ*. Then the *Hesperidæ* only will remain, and to that family those who wish to help in the work should turn their attention betimes.

NOTES ON OATES' BIRDS OF INDIA.

Part II.

THE interest in Mr. Oates's work will be felt beyond the limits of the Avi-fauna on which he writes, for he has put forward some new and original notions for the classification of the Passerine birds, a subject which will attract the attention of Ornithologists all over the globe. Of this new attempt to re-arrange the Passerine birds, we feel very much as we have felt with regard to all similar attempts of the last twenty years. Each one leans too much on a single character, but each adds something in the way of a brick or two of information towards the building up of a natural classification of Passeres. We are beginning to doubt, however, whether we shall ever arrive at a really natural classification, and certainly we shall not get a linear one. There seems to have been too much endeavour to thrust odd genera into families, in an attempt to make them fit in somewhere, and we shall really only be able to generalise when we know everything about all the leading genera, external contour, osteology, myology, nesting habits, colour of eggs, &c. No character can be considered too unimportant, all must be weighed, and then we may hope that, by a combination of knowledge on every minute point, we may arrive at some satisfactory conclusion. Nomenclature now troubles the ornithological world much less than classification, and it is time that a detailed scheme was prepared for submission to a competent international committee, and discussed at a Zoological Congress. The *imprimatur* which is given by the annual meetings of the American Ornithologists' Union to the status of various species in the list of North American birds is an admirable institution, and a committee of the B.O.U. might do useful work in the same way.

The question now arising is, whether systematists are not walking in a wrong direction, when they feel bound to place their genera in some well-known family; as, for instance, Mr. Oates has done in the present volume with *Zosterops*. The liability to do this is sure to be stronger when the writer is dealing with the birds of one region only. *Zosterops*, as represented in the Indian region, only exhibits a paltry five species out of the eighty of which the genus is composed. Then, again, has not too much stress been placed on single characters, such as the number of primary quills, the shape of the wing, &c.? The concave Timeliine shape of the wing, which led Mr. Seebohm to discard *Cisticola* from the Warblers, is reckoned of little worth by Mr. Oates when the spring moult is found to be common to both groups of birds. Not that we are disposed to quarrel with either of these views: they are merely part of the grouping in which we are all engaged towards the accomplishment of a natural system; but let us see what result follows from the adoption of Mr. Oates's characters. First of all he recognises the two great groups, *Acromyodi* and *Mesomyodi*. With this we are most of us agreed. Then he separates off the Larks on account of their scutellated *planta tarsi*, a striking character, and the *Diceidæ* follow on account of the serrations in the tomia. Then the nine-primaried birds go on one side—*Hirundinidæ* or Swallows, *Fringillidæ* or Finches, and *Motacillidæ* or Wagtails and Pipits. Of the ten-primaried Passeres, the Sun-birds (*Nectariniidæ*) are placed on one side because of their tubular and extensile tongue; and the other families are divided according to the character of the nestling plumage. Dr. Shufeldt has recently written a paper on the osteology of North American Passeres, from which we gather very few crumbs of comfort; and we doubt whether any great differences of structure are going to be discovered in the families of Passeres, all of which seem to be built on one type. The study, however, is too much in its infancy for us to know anything yet for certain.

With regard to the nine-primaried birds, all of which we have described in the British Museum "Catalogue," can any naturalist venture to say that there is any real natural affinity between Swallows and Finches, or between Finches and Pipits, or between Swallows and Wagtails? They seem to us about as distinct from one another as any families of birds can well be, and if their proximity in the system is due to their having all of them nine primaries, then this character cannot be worth much if it leads to such a result. In our arrangement of Passeres in the "Catalogue" we began with the *Corvidæ* as the highest type of bird in our opinion. Since that date (1877) our knowledge of Passerine birds has been enormously increased, and, although our idea of the high position of the *Corvidæ* has been upheld by Professor Newton, Dr. Shufeldt, and other naturalists, it is for the very reason that it is a perfect type of Passerine bird that the Raven ought to be placed in the *middle* of the system, but not at either *end*.

Thus, supposing that the *Corvidæ*, as represented principally by the genus *Corvus*, be admitted, for the sake of argument, as the highest type of Passerine bird, in what relation would the other families stand towards it, if we try to illustrate their natural relationships by a table?

Accentoridæ Hirundinidæ
Turdidæ—Sylviidæ
Cinclidæ Muscicapidæ
Troglodytidæ Timeliidæ

Dicruridæ
Paradisiidæ Artamidæ
Corvidæ Oriolidæ
Ptilonorhynchidæ Eulabetidæ
Sturnidæ

Ampelidæ Diceidæ—Meliphagidæ—Nectariniidæ
Regulidæ—Paridæ
Certhiidæ Laniidæ
Mniotiltidæ Vireonidæ

Cærebidæ
Tanagridæ Motacillidæ
Alaudidæ

Ploceidæ
Icteridæ Fringillidæ

From the foregoing table it will be seen that we consider that there are three main groups of families, which may be considered as really related more or less *inter se*. First, the Thrushes or Turdiformes. That the *Turdidæ* and *Sylviidæ* are closely interwoven no one will deny, and we must place the *Cinclidæ* near the *Turdidæ*, though their nest-building habits and their want of rictal bristles lead towards the Wrens. Other families may be ultimately added to this Troglodytine group, such as *Mimidæ*, *Myiadestidæ*, &c.; but that the three leading forms of Turdine families, *viz*., Thrushes, Warblers, and Flycatchers, are well characterised seems to be as incontestable as the fact that they are intimately related.

Another group of birds of which the relationships are obvious seems to us to consist of the Crows, Starlings, and Paradise-birds. Starlings ought not to be divorced far from the Crows, both being *Ambulatores*, and further connected by *Heteralocha*, *Podoces*, *Pyrrhocorax*, and another genera. Mr. Oates's family Eulabetidæ can lead from the *Sturnidæ* to the *Oriolidæ*.

The only other assemblage of birds which can apparently claim united affinities are the Finches, which coalesce with the Tanagers on one hand, and with the Weaver birds on the other, and these are not far removed from the Hangnests, *Icteridæ*.

All the other families of birds seem to stand more or less isolated. The *Hirundinidæ* are decidedly a family apart, their nearest relatives being apparently *Muscicapidæ* through such forms as *Artomyias*.

The *Ampelidæ* have no very near relations, as far as we can judge, but Shufeldt places them between the *Laniidæ* and *Hirundinidæ*.

The *Laniidæ* also stand by themselves as the centre of a cluster of families, which are, however, none of them absolutely connected at the present day. The Shrikes approach the *Paridæ* through *Falcunculus*, and on the other hand the *Vireonidæ* cannot be far off, though, according to Shufeldt, they show great affinity for the *Mniotiltidæ*.

The *Atamidæ* have apparently no close relations. Mr. Oates puts them as a sub-family of the *Laniidæ*.

The *Paridæ* are intermediate between the *Laniidæ* and the *Certhiidæ*, and we should not feel inclined to separate the Nuthaches as a distinct family from the *Paridæ*; but this is a small matter, and they can be placed as a family between the Creepers and the Titmice by those who consider them worthy of a distinct position. Dr. Shufeldt inclines to the latter view.

The *Regulidæ* are a tiny family, but it seems convenient to keep them distinct, near the *Paridæ*, with inclinations towards the *Sylviidæ*.

The *Mniotiltidæ* occupy the same position in the New World that the *Sylviidæ* do in the old, but beyond this they do not seem to be actually related, and they are more nearly connected with the *Certhiidæ* through *Mniotilta*.

The *Cærebidæ* appear to us to constitute a separate family somewhat intermediate between the *Certhiidæ* and the *Tangaridæ*.

The *Dicruridæ* are another rather isolated family, somewhat Muscicapine, somewhat Laniine, and yet showing a slight affinity towards the Orioles.

There remain, therefore, only the Larks and the Wagtails, both families standing somewhat apart, but we believe that too much has been made of the scutellate *planta tarsi* of the Larks, and that they are really closely allied to the Finches through the Buntings, and especially connected by *Plectrophenax* of the *Emberizidæ* and *Otocoris* of the *Alaudidæ.*

The *Motacillidæ*, with their lark-shaped wing and their lark-like nesting habits, ought not to be very far from the *Alaudidæ,* though with affinities pointing to the *Sylviidæ*

Dr. Shufeldt, in his recently published "Contributions to the Comparative Osteology of the Families of North American Passeres," has arranged the latter in the following order : —

Order.	Sub-order.	Families.
Passeres	Clamatores	1. Tyrannidæ
	Oscines	2. Laniidæ
		3. Ampelidæ
		4. Hirundinidæ
		5. Alaudidæ
		6. Certhiidæ
		7. Vireonidæ
		8. Motacillidæ
		9. Sylviidæ
		10. Cærebidæ
		11. Mniotiltidæ
		12. Cinclidæ
		13. Troglodytidæ
		14. Turdidæ
		15. Paridæ
		16. Tanagridæ
		17. Fringillidæ
		18. Icteridæ
		19. Sturnidæ
		20. Corvidæ

Now, it is difficult enough at any time to arrange families of birds in linear sequence, so as to preserve a correct notion of their natural affinities, because, however easily one may commence the order, a sudden stop must ensue when the limits of natural groups are reached, and a fresh start must be made. This must be the case, for instance, when we come to a family like the *Sylviidæ,* which have many close allies, and cannot stand in the linear system between more than two of them

We propose the following linear arrangement of the families of Oscines, as the best compromise which has suggested itself to us.

1. Corvidæ (Crows).
2. Paradisiidæ (Birds of Paradise).
   Ptilonorhynchidæ (Bower Birds).
4. Sturnidæ (True Starlings).
5. Eulabetidæ (Tree Starlings).
6 Artamidæ (Swallow Shrikes).
7. Dicruridæ (Drongos).
8. Oriolidæ (Orioles).
9. Icteridæ (Hangnests).
10. Ploceidæ (Weaver Birds).

11. Tanagridæ (Tanagers)
12. Cærebidæ (American Creepers).
13. Fringillidæ (Finches).
14. Alaudidæ (Larks).
15. Motacillidæ (Wagtails and Pipits).
16. Mniotiltidæ (American Warblers).
17. Certhiidæ (Creepers).
18. Meliphagidæ (Honey-eaters).
19. Nectarinidæ (Sun-birds).
20. Diceidæ (Flower-peckers).
21. Paridæ (Titmice).
22. Regulidæ (Gold-crests).
23. Laniidæ (Shrikes).
24. Ampelidæ (Chatterers).
25. Vireonidæ (Greenlets).
26. Sylviidæ (Warblers).
27. Turdidæ (Thrushes).
28. Cinclidæ (Dippers).
29. Troglodytidæ (Wrens).
30. Accentoridæ (Accentors).
31. Timeliidæ (Babblers).
32. Pycnonotidæ (Bulbuls).
33. Campophagidæ (Cuckoo-Shrikes).
34. Muscicapidæ (Flycatchers).
35. Hirundinidæ (Swallows).

As with Dr. Shufeldt's arrangement, so with ours, there are one or two awkwardly placed families. It is annoying to have to separate the *Paridæ* so far from the *Certhiidæ* ; but we do not see where else to put the *Meliphagidæ*. The *Sturnidæ* too, are further from the Crows than we should prefer to see them ; but if we begin with the *Corvidæ*, which we think it is desirable to do, the transition to the Paradise-birds seems natural, and thence the way is easy through *Xanthomelus* to *Amblyornis*. Then comes a break, for we do not think that there is any real affinity between the Orioles and the Bower-birds, and the *Sturnidæ* come here as the nearest position available in the vicinity of the *Corvidæ*. Recognising the sense of Mr. Oates's family *Eulabetidæ*, we can pass by way of *Calornis* to the *Oriolidæ*, and thence to the *Artamidæ* and *Dicruridæ*. It would not surprise us if, when the osteology and anatomy of these two last families are worked out, they are taken completely away from their present position, and placed nearer to the *Muscicapidæ* or the *Laniidæ*. At present we do not know any better place to put them. That the Orioles of the Old World and the Orioles of the New World should come somewhere near each other is convenient, and then the passage to the Weavers, Tanagers, and Finches is easy, but the position of the *Cærebidæ* does not quite please us. The latest exponent of the group, Dr. Sclater, considers that they are related to the *Tanagridæ* on one hand and to the *Certhiidæ* and *Mniotiltidæ* on the other. Dr. Shufeldt places them next to the latter family, and it may be that their Mniotiltine will over-ride their Tanagrine affinities. We have already alluded to the connection between the *Alaudidæ* and *Fringillidæ* by means of the Horned Larks and the Snow or Lapland Buntings, and by placing the *Motacillidæ* next in order, we can proceed to the *Mniotiltidæ* by way of *Siurus* as Dr. Shufeldt has pointed out. From *Mniotilta* to *Certhia* seems an easy transition, and then, no doubt, we ought to go the Nuthatches and Titmic. But we can find no more convenient position than this for placing the *Meliphagidæ* and the *Nectariniidæ*, and the thread of continuity is once more taken up by the *Diceidæ*, which form a good connecting link with the *Paridæ* by way of *Prionochilus*, *Pardalotus*, but above all by *Oreocharis*. From *Paridæ* to *Laniidæ* the road is bridged by *Falcunculus*, and probably here will have to come some of he aberrant *Liotriches*, which are most puzzling birds to locate. We follow Mr. Oates in placing them as Timeliinæ birds, but both our family *Timeliidæ* of the "Catalogue" and Mr. Oates's family *Crateropodidæ* have too ample limits.

The *Vireonidæ*, according to Dr. Shufeldt, are more Mniotiltine than Laniine, and the importance of their form of bill has been exaggerated, while the *Laniidæ* have got such remarkable osteological characters, that Dr. Shufeldt has put them on the boundary of Passeres. Mr. Oates, for quite other characters, also puts them far from the *Paridæ*. Whether our position for the Shrikes is natural is a fair subject for discussion, our chief objection to it being that it separates the *Sylviidæ* so far from the *Mniotiltidæ* in the linear series. Once, however, that we have passed this break in the natural order, and we arrive at the *Sylviidæ*, the affinities of the *Turdidæ*, *Cinclidæ*, and *Troglodytidæ* are evident, the Accentors are probably rightly placed in proximity, and the *Timeliidæ* in their comprehensive sense follow. The affinities of some of these birds with the *Muscicapidæ* are closer than would be imagined, but Mr. Oates's favourite character of the spotted young is of great use in determining the limits of these two families.

R. BOWDLER SHARPE.

—*The Field*, 12*th April* 1890.

MISCELLANEOUS NOTES.

I. PAINTED SANDGROUSE NEAR BARODA.

ON July 6th I got a pair of common Sandgrouse near Sikandarpur village, about three miles east of Baroda, and shortly afterwards put up two Sandgrouse, which proved to be painted, not common, Sandgrouse. Next day six more were seen and some shot near the same place. This is the first time I have met the painted Sandgrouse west of Champanir. It is common at the foot of Pawagadh hill, and in the summer may be seen at dusk—it is crepuscular—drinking at the Vada-talao beyond Champanir. The birds shot on the 6th and 7th at Baroda were on an open plain with scattered bushes.

H. LITTLEDALE.

Baroda, July 1890.

II. THE GADWALL AND BLUE-BEAKED BOOBY.

YESTERDAY, 15th June 1890, a shikari brought me a yearling female Gadwal, freshly shot. It had apparently suffered some injury to one wing, which must have prevented its migration, but was quite fat and in excellent condition for the table.

On the same day I saw a storm-driven specimen of *Sula cyanops*, the Blue-beaked Booby. It is not uncommon for these birds to be brought up here by south-westerly gales and caught by hand.

W. F. Sinclair, Bo. C.S.

Alibag, 16*th June* 1890.

3. A TRAIT OF HEREDITY.

In June last, at Chikalda, I took three young bulbuls of the common kind two or three days after they were hatched out, and brought them up by hand. They had consequently no acquaintance with their mother or her ways. Shortly after these three birds were fully fledged, and able to hop and fly on to their perch, two of the young of the white-throated crested bulbuls were brought to me, and put by me into the same cage as the other three. I continued to hand-feed all. Suddenly one day a female of the earlier lot, after her own appetite was satisfied, and before I had attended to the two junior ones, who were vigorously attracting my attention, taking what I gave her, fed first one and then the other, and from that day has gone on feeding them just as their natural mother would have done, and as if she herself had years of experience and had brought up numerous families.

The trait seems to me sufficiently curious to note in the Journal.

Personally I am not aware that a fact of the kind has been observed before, though I dare say it has, for there is little, if anything, new under the sun.

Kenneth Mackenzie, Colonel.

Amraoti, Berar, July 1890.

4. EGG-LAYING ANIMALS.

At the President's Soirée at the Royal College of Surgeons, held in London on 27th June, by far the most interesting exhibit, so far as zoologists are concerned, was that of Mr. W. H. Caldwell, of Cambridge, who, it will be remembered, was sent out by his University to Australia to study the life history of the Ornithorhynchus and Echidna, and trace the development of the young through all stages from the egg.

The Ornithorhynchus builds a nest at the end of one of the subterranean burrows which start from the water hole in which the animal feeds. The eggs are two in number, and are sat upon until hatched, when the young, measuring barely three-quarters of an inch in length, at once begin to lap the milk supplied by the mammary glands of the mother.

Echidna lays, as a rule, only one egg, and carries it in a pouch formed by a fold of skin surrounding the mammary glands. The young animal remains in the pouch for many weeks.

Mr. Caldwell's series, showing seven stages of development, included (1) egg of Echidna, taken from the uterus, showing the meroblastic segmentation at the stage of two furrows, with four segmentation nuclei, the small circular white spot being the embryonic area; (2) older egg of Echidna, from the uterus, about the stage of a two-day chick; (3) still older egg of Echidna, from the uterus, equal to a four-day chick; (2 and 3) have increased in size by absorption of fluid from the uterine glands, as in the higher mammalia; (4) laid eggs of Ornithorhynchus and Echidna; (5) recently hatched young Echidna, with remains of shell, found together in the mother's pouch; and (7) older stages of Echidna.

The adult Ornithorhynchus possess a duck-like bill which is destitute of teeth, although, until the animal is half-grown, it possesses true teeth (twelve in number) which disappear as development proceeds. They are lost by shedding, their place being taken by horny thickening of the gum which precedes the shedding.—*The Field, 5th July* 1890.

A PANTHER CHASING A NILGHAI.

The following is, I think, worth recording, as it illustrates an exceptional method of hunting, which the Panther is occasionally forced to adopt.

In August last, I was asked by the Patel of a village in the Amraoti district to accompany him one evening to a forest nursery of young bamboo shoots, to assist in killing a large boar which nightly visited the place and did immense damage. We waited for some time, when just as it was getting dark, we heard the short guttural sound of a Panther and heavy footfall of some running animal. The noises came nearer and nearer, until a Nilghai and a Panther could be distinctly seen against the sky-line, the former being chased by the latter. The Nilghai kept moaning, and was evidently in an abject state of fear.

The two ran round in a circle of about 160 yards diameter within 30 yards of where we were standing, and passed us twice, both of them making their respective noises. They then disappeared, but I have reason to believe the nilghai got away.

I was so interested in the sight that I did not think of firing, but it would have been an exceedingly difficult shot in the dusk.

J. M. COODE.

NAGPUR, C. P,
August 1890.

6. THE PROTECTIVE COLOURING OF CHRYSALIDES.

It is well known that many butterflies and moths in their larval and imago states imitate and assume the forms and colours of various animals and things for protective purposes, but though only hinted at, it does not appear to be known that in their chrysalis stage also an All-Wise Providence has gifted them with the means of eluding discovery and escaping detection, thereby completing the chain of wonderful similitude from beginning to end. The hint above referred to will be found, so far as I know, only in the *Butterflies of India*, where it is stated that the chrysalis of *D. chrysippus* assumes two forms, the one being green, its normal color, and the other a delicate pink, from which it is inferred that the latter colour may be due to its imitating the tint of the buds and flowers of the food plant, which are pink.

Unless there be two well-marked and constant varieties of these pupæ, which I doubt, the hypothesis is correct, but nowhere, except among the blossoms themselves or in their immediate vicinity, can such a change take place, as certain conditions seem essential for perfecting themselves in the colour of their surroundings.

From the few experiments I have as yet made, and which I shall now record, I believe that the faculty for protective colouring is strongly developed in all chrysalides (I am not in a position to say, however, whether it is effected naturally or wilfully, but believe the former to be the case), and that they possess the means of toning themselves to their surroundings. Perhaps I may be too sweeping in asserting that all chrysalides can do so, as in the present early stage of the investigation, one cannot be too certain of results that are to be acquired only on patient and careful research, but should any eventually be found constant to their normal colour, I feel confident they will not prove the largest number.

Thus far I have experimented on only two species of butterfly, common ones luckily, but belonging at the same time to quite distinct families and the results have interested and astonished me in no small degree.

Danaïs chrysippus was one of my "subjects" and as stated above the colours of its pupæ are either green or pink, but following up a slight change of colour that accident put into my hand I succeeded in getting them pure *white, red, salmon, black* and *blue.* The two last colours, however, were not quite pronounced like the rest, and were due, no doubt, to a slight error in operation, which I shall explain further on.

The other insect was *P. erithonius*, the eggs and larvæ of which I got off a bael tree, *Ægle marmelos.* (I do not know if this has been recorded as one of its food plants, as writing away from all my books and papers, I have not the facility of a reference, though *I fancy* it has been noted as such.) The pupæ of this butterfly also are green, but in this instance even I succeeded in changing them to red, pink, salmon, brown and other colours. Now these are curious and interesting results, no doubt, and how were they arrived at? Simply by following certain rules that would have come into full play in nature, and from which I conclude that the pupæ of butterflies can be made to assume any tint, as it is a provision for protective purposes. The subject, however, is not fully investigated as yet, and I therefore throw out these few hints in the hope that other members of the Society may follow them up, and place us in possession of some more interesting facts.

A few hints seem necessary to carry out the investigation successfully, barring which the experiments will result in failure. A strong light seems an indispensable condition in securing any given colour in a chrysalis. When the caterpillar is fully grown and ready to change into its pupa stage, put it into an open box—a soap box answers the purpose admirably—and fasten round it *thin* paper of the colour you wish, and submit it to a strong light, (mine were arranged against a glass window, where the sun shone in) and allow to remain there till the transformation is completed. In from eighteen to twenty-four hours after this has been accomplished, the paper may be removed, when the chrysalis will be found to have assumed the desired colour. Thick paper does not seem to answer, nor yet does covering up in a dark place, as the pupæ then assume their normal colour, and it is to this cause I attribute my failure in securing a black or blue chrysalsis, the material used having been too thick for the purpose.

A. W. MORRIS, F.Z.S.

"BOTHWELL CASTLE,"
Bangalore, August 27th 1890.

PROCEEDING.

PROCEEDINGS OF THE MEETING ON 7TH JULY 1890.

The usual Monthly Meeting of the Members was held on Monday, the 7th July, the Hon'ble Mr. Justice Birdwood presiding

The following new Members were elected:—Mr. H. A. Acworth, Bombay Civil Service, Captain J. Burn-Murdoch, R.E., Mr. James MacNabb Campbell, Bombay Civil Service, Colonel H. L. Nutt, H. H. Prince Kumar Shri Bhaosinghji of Porebunder, Mr. F. Bernard O'Shea, Mr. R. Logan, Bengal Civil Service, Mr. G. Gilbert White (Nagpore), Major C. A. R. Sage, S. C. (Dharamsala), Mr. C. B. Evatt (Sogra), Mr. H. Monie, Mr. J. H. B. Hallen, A. V. D. (Simla), Mr. J. B. F. Bevan, Mr. J. M. Coode, Mr. A. Higgins (Berars), Mr. Richard Meredith, Mrs. Robinson, Mr. H. Whitby Smith (Bhownugger), and Mr. H. H. Jones.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions to the Society's collections, *viz.*:—

CONTRIBUTIONS DURING MAY AND JUNE.

Contribution.	Description.	Contributor.
1 Owl (alive)	Strix javanica	Dr. Kirtikar.
2 Gazelles (alive)	From Persia	Capt. A. S. Houstoun.
105 Birds' Eggs	From Saugor (C. P.)	Lieut. H. E. Barnes.
3 Birds' Nests	Do.	Do.
2 Snakes	Do.	Do.
2 Lizards (alive)	Uromastrix hardwickii	Mr. C. M. Sykes.
2 Young Crocodiles (alive).	Crocodilus palustris	Mr. O. Meyer.
1 Snake (alive)	Ptyas mucosus	Do.
A quantity of Butterflies	From the Chin-Lushai Country.	Lieut. D. Thomson.
1 Smaller Sea Tern (alive).	Sterna media	Miss Florence Bapty.
1 Sooty Tern	Sterma fuliginosa	Do.
A number of deep sea Corals and other Marine specimens.	From the Laccadive Seas (1,000 Fathoms).	Dr. Alcock.

Contribution.	Discription.	Contributor.
1 Honey Bagder	Melivora indica	Mr. Proctor Sims.
A quantity of Land Crabs (alive).	From Alibag	Mr. G. K. Betham.
1 Grey Pelican	Pelecanus philippensis	M. Cowasjee Dady Limjee.
2 Porcupines (alive)	Hystric leucura	Mr. F. L. Goldsmid, C.S.
1 Brown Tree Snake	Dipsas gokool	Mr. G. Ormiston.
1 Snake (alive)	Psammophis leithii	Mr. B. W. Blood.
Several Hippopotamus Tusks.	From Zanzibar	Major Radcliffe.
3 Fœtal specimens	Felis pardus	Mr. W. F. Sinclair, C.S.
1 Panther's Skull	Do.	Do.
1 Flustra	From Goa	Mrs. Oliver.
1 Great Hornbill	Dichoceros cavatus	Mr. P. B. Smith.
1 Fœtus of Hare	Lepus nigricollis	Lieut. Jas. Devine.
1 Dhaman (alive)	Ptyas mucosus	Mr. G. E. Ormiston.
1 Sea Snake (alive)	Pelamis bicolor	Do.
1 Hyæna's Skull	Hystrix striatus	Capt. Hibbert.
1 Screech Owl (alive)	Strix javanica	Mrs. H. G. Kees.
8 Lizards (alive)	Sitana ponticeriana	Mr. H. M. Phipson.
A quantity of Butterflies	From the Chin-Lushai Country.	Mr. F. E. Dempster.
1 Scaly Ant Eater (alive)	Manis pentadactylus	Mr. E. F. Ansell.
1 Cobra (alive)	Naga tripudians	Mr. G. Carstensen.
1 White Booby	Sala cyanops	Dr. D. A. D' Monte.
1 Chameleon (alive)	Chameleo vulgaris	Mr J. Wolfe.
1 Four-legged Chicken (alive).		Dr. D. A. D' Monte.
1 Great Hornbill (alive)	Dichoceros cavatus	Mr. Hiscock.
A collection of Snakes and other Reptiles.	From Java (through Lieut. Pilleau.)	Mr. Kerkhoven.

Minor contributions from Dr. Langley, Mr. F. A. Little, Mr. G. E. Ormiston, Mr. Lauder, Capt. Thorburn, Mr. H. Corke, Mr. C. F. G. Lester, Mr. J. Etlinger, Mr. J. G. Lynde, Mr. E. A. Corke, and Mr. John Kersten.

CONTRIBUTIONS TO THE LIBRARY.

"Journal of Comparative Medicine," Vol. XI., Nos. 4 and 5; in exchange.

"Etudes Myrmecologiques en 1886" (Auguste Forel), presented by the author.

"Proceedings of the Linnæan Society of N. S. Wales," Vol. III. Part 4, in exchange.

"The Butterflies of India, Burmah, and Ceylon," Vol. III. (de Nicéville), presented by Mr. H. Curwen.

"Memoir of the Geological Survey of India," in exchange.

"The Fauna of British India (Mammalia)," interleaved copy presented by Mr. W, F. Sinclair, C.S.

"The Avi-Fauna of British India (Murray)," interleaved volumes, presented by Mr. W. F. Sinclair, C.S.

"Journal of the Asiatic Society of Bengal," Vol. LVIII., No. 14, with supplements, in exchange.

"Catalogue of the Insects of the Oriental Region" (Atkinson), presented by the author.

"Notes on Rhynchota" (Atkinson), presented by the author.

"Flora of British India," Part XVI. (Hooker), presented by the Secretary of State.

"The Indian Forester," Nos. 4, 6, in exchange.

CHIN-LUSHAI EXPEDITION.

A special vote of thanks was passed to Lieutenant D. Thomson, of the 28th Pioneers, and Mr. F. E. Dempster, of the Telegraph Department, for the valuable collections of Butterflies which these gentlemen had made for the Bombay Natural History Society during the Chin-Lushai Expedition.

PANTHERS TREE'D BY WILD DOGS.

The Honorary Secretary read a short note from Mr. Fred. Wright, of Chickalda, giving a graphic account of two panthers being tree'd by wild dogs on the banks of the Gogra River. The Honorary Secretary stated that the note would be printed in full in the Society's Journal No. II., which was now being struck off.

AN APPEAL FOR HELP.

The Honorary Secretary stated that he had received a letter from Mr. Robert C. Wroughton, of Poona, who had made a valuable collection of ants for the Society, asking for assistance in the collection and observation of these interesting creatures, Mr. Wroughton stated that he had forwarded to Dr. Forel a number of specimens collected by Mr. F. Gleadow, which had led to the important discovery that *Œnictus* and *Typhlatta* were one genus. The former being the older, the genus *Typhlatta* would be now given up. Several specimens of the male of *Dorylus* were exhibited, and the members of the Society were earnestly entreated to assist in the discovery of the female of this ant, for which entomologists had been searching in vain for many years. A number of the males had recently been captured by a gentleman in Bombay, issuing from the foundations of his bungalow. Mr. Wroughton had immediately suggested that the house should be pulled down in order that the nest might be excavated.

Dr. W. Dymock then read an interesting paper, entitled—

NOTES ON THE ECONOMIC BOTANY OF THE CUCUBRITACÆ OF WESTERN INDIA,

which will be found on page 286.

The Hon'ble Mr. Justice Birdwood proposed a vote of thanks to Dr. Dymock for his interesting paper, which contained so much valuable information. He also drew the attention of the Members to the great importance of fruit and vegetable cultivation, and expressed his regret that Europeans in this country did not interest themselves sufficiently in the subject. Mr. Birdwood pointed out that the Society's Herbarium was at present a very small one, and hoped that members who had the opportunities would assist in increasing it, as the want of a good representative collection of plants was much felt by all botanical students in Bombay.

PROCEEDINGS OF THE MEETING ON 11TH AUGUST 1890.

The usual Monthly Meeting of the Members of this Society took place at their Rooms, in Apollo Street, on Monday, the 11th August, Deputy Surgeon-General W. E. Cates, presiding.

The following new members were elected:—Major E. Buckle, R.A. (Kurrachee); Major D. Robertson (Rewa); and Lieut. D. J. Peart (Sehore).

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions:—

Contributions during July.

Contributions.	Description.	Contributors.
1 Young Ostrich	Born in Bombay	Victoria Gardens.
1 Persian Gazelle	Gazella subgutterosa	Do.
2 Black Buck's Heads	Antelope bezoartica	Do.
1 Great Hornbill	Dichoceros birostris	Do.
A number of Snake's Eggs.	From Khandeish	Mr. Wm. Rodgers.
1 Florican	Sypheotides aurita	Capt. A. Gwyn.
1 Panther's Skull	Felis pardus	Mr. J. M. Coode.
1 Snake (alive)	Tropidonotus stolatus	Mr. B. W. Blood.
1 Monitor (alive)	Varanus bengalensis	Do.
1 Snake (alive)	Ptyas mucosus	Mr. T. H. Jolly.
2 Toddy Cats (alive)	Paradoxurus musanga	Mr. J. Wright.
1 Tailor-Bird's Nest	Orthotomus sutorius	Mr. B. A. Gupte.
1 Crow's Nest	Made of metal	Col. Riddell, R.E.
2 Snakes (alive)	Tropidonotus stolatus	Mr. O. Meyer.
1 Monitor (alive)	Varanus bengalensis	Do.
4 Snakes	Halys himalayanus	Col. Hore.
1 Krait	Bungarus arcuatus	Mr. W. O Mosse.
1 Tailor-Bird's Nest	Orthotomus sutorius	Mrs. G. Hepworth.
1 Marmot's Skull	Arctomys sp.	Major Buckle, R. A.
A collection of Moths	From Rutnagiri	Mr. E. A. Bulkley.
1 Comb Duck (alive)	Sarcidiornis melanonotus	Col. H L. Nutt.
1 White Booby	Sula cyanops	Mr. C. M. Stuart.
1 Calculus	From a Bullock's Kidney	Mr. F. Gleadow.

Minor contributions were also acknowledged from Mr. Robt. Wroughton, Mr. A. C. Walker, Mr. George Ormiston, Mr. J. Stiven, and Mr. B. W. Blood.

Contributions to the Library.

Proceedings of the Linnæn Society of N. S. Wales, Vol. V., Part I., in exchange. The Indian Forester, No. 7, in exchange. Verhandlungen der Naturforschenden Gesellschaft in Basel, Vol. 8, in exchange. Transactions of the New Zealand Institute, for 1889, in exchange. Catalogue of Ants in the British Museum (F. Smith) from Mr. G. A. J. Rothney, Oriental Hymenoptera, Part II. (P. Cameron), from Mr. G. A. J. Rothney. Transactions of the Royal Society of Victoria, in exchange.

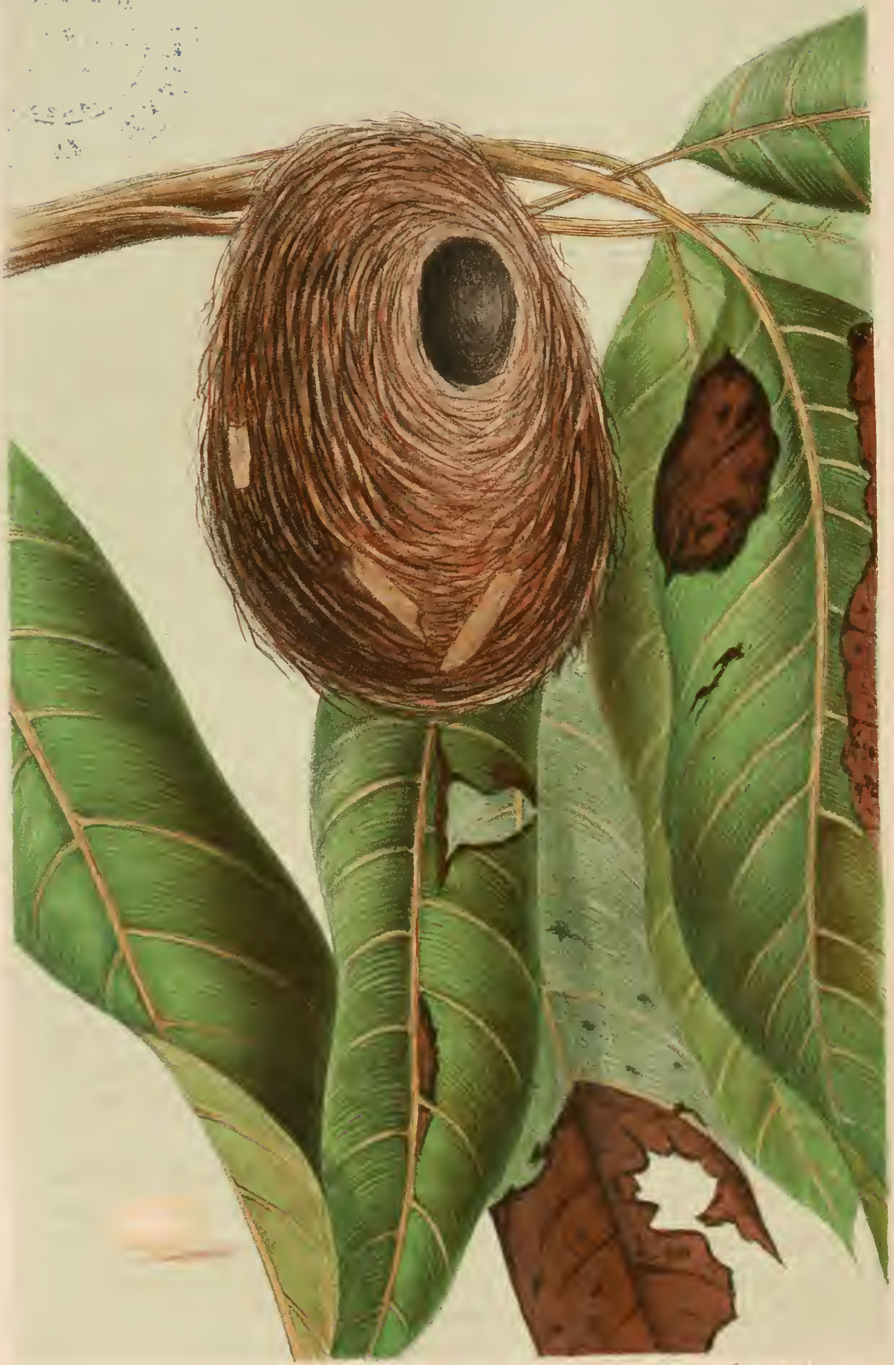
MISCELLANEOUS NOTES.

A note was read from Mr. H. Littledale, of Baroda, recording the Painted Sandgrouse at Sekandarpur, on the 6th ult. A curious instance of young birds feeding each other was also referred to in a note from Colonel Kenneth Mackenzie, which appears in the Journal (*vide* page 306.)

HOOKER'S FLORA OF BRITISH INDIA.

The Honorary Secretary drew the attention of the members to an extra copy of the above work, Parts Nos. I. to XVI., complete as far as published, which was for sale, for Rs. 85.

Mr. J. H. Steel, A.V.D., then read an interesting paper on MULES, which will be found on page 252 of this number.



H.B. del

Mintern Bros. Chromo lith. London

238. DICÆUM ERYTHRORHYNCHUS, Lath.

Tickell's Flower Pecker.

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JOURNAL
OF THE
BOMBAY
Natural History Society.

No. 4.] BOMBAY, 1890. [Vol. V.

NESTING IN WESTERN INDIA.

By Lieut. H. E. Barnes, F.Z.S.

(*Continued from* p. 116.)

(*With a Plate*).

706.—THE COMMON HOUSE SPARROW.

Passer domesticus, Lin.

The House Sparrow is common everywhere, on the hills as well as on the plains. They are so well known that it is quite unnecessary to say much about them. During the breeding season, which commences in February and continues for some months, they are positively unbearable, on account of the litter they make when constructing their nests. No amount of persecution seems to deter them from building in a place when they have once made up their minds to it.

At Deesa, I had a great number of different kinds of birds in a large aviary, which evidently attracted the sparrows and they became a positive nuisance. I refrained from interfering with them, and naturally they took advantage of me. I have since acted towards them in a much less forbearing spirit. There seemed to be a nest in every spot where it was possible to put one.

Almost every picture hanging at an angle from the wall had one. There were several nests in the ceiling, for wherever they found a hole in the cloth, they would keep pecking at it, until they made it large enough to admit them, and as they used the same places for successive broods, adding fresh material each time, they soon made the ceiling cloth unsightly, and once or twice they caused it to give way.

From a rolled up chick, hanging in the doorway, I thrice took eggs, and even then they would not forsake the nest, and I had to unroll the chick and keep it down.

A pair built a large nest in the antlers of a sambur in the verandah.

Another pair made a nest in the soap box in the bath room, and although the nest was destroyed several times, they would not desist, and at last from sheer pity, I had to leave them alone.

The most peculiar case was when a pair had a nest in a bird cage hanging against the wall, just above where the *durzi* sat all day working, and close to a door, where people were passing in and out continually; the door of the cage had been left open, the previous occupant having been transferred to the large aviary; in this they not only laid four eggs, but actually reared the nestlings, although the cage was frequently taken down to show visitors. Once they nearly lost their eggs, as a boy who was staying in the house with his mother, on a visit, took them out and had them in his possession for some time, before he was found out. I replaced them and they were duly hatched. The fuss the birds made, when their eggs were stolen, led to their recovery.

A large punkah in the sitting room, which was kept swinging almost the whole day with scarcely any intermission, happened to have a small hole in the canvas, just large enough to admit a sparrow, and in this peculiar place, between the two cloths, a pair decided to have a nest; they reared a brood in safety, and commenced preparations for another, when they were interfered with by a rival pair, and after a severe contest which lasted several days, they had to relinquish their claim, and give up possession; strange to say, they pecked a hole in the canvas at the other end of the punkah, and there they reared another brood in safety.

I have often had to turn the face of a looking glass to the wall, to prevent the sparrows from injuring themselves, for immediately one of them catches a glimpse of himself in it, he commences a furious onslaught, on what, he imagines, must be a rival, and if not prevented, will continue fighting the whole day, only leaving off when darkness sets in, recommencing the battle at dawn the next day. I once tried to see how long it would be before the bird gave in, but after two days, seeing no likelihood of his retiring from the unequal contest, I took pity on him and had the glass covered up. The bird did not seem in any way exhausted, although I do not think that he had a morsel of food for two days.

The nests are shapeless masses of grass, straw, and string; almost anything they can find is made use of; the eggs, four in number, occasionally five, are subject to much variation in size, shape and colour.

In shape, they are usually a longish oval, pinched in a little at one end; in colour they are greenish-, greyish-, or yellowish-white, and the markings consisting of spots, streaks, specks, and blotches, are olive-, yellowish-, or purplish-brown; sometimes the ground colour is almost pure white, but generally the egg is dull and dingy. They average about 0·8 inches in length, by about 0·6 in breadth.

709.—THE RUFOUS-BACKED SPARROW.

Passer pyrrhonotus, Bly.

After a lapse of forty years, this bird has been rediscovered by Mr. Doig; he found them breeding in a swamp, along the banks of the Eastern Narra Canal in Sind.

The nests were exactly similar to those of the Common House Sparrow (*Passer domesticus*), only rather smaller; they were placed in the topmost branches of some small acacia trees, growing in the water, and were about twelve feet above the water line. All the nests had young ones more or less fully fledged.

711.—THE YELLOW-THROATED SPARROW.

Gymnoris flavicollis, Frankl.

The Yellow-throated Sparrow occurs throughout Western India; in some districts it is very common. It is a permanent resident, breeding during the hot weather. As a rule the nest is placed in a hole in a tree, generally the hole is a very small one, entailing a great deal of cutting before the eggs can be got at. They sit very close; on one occasion I had been cutting and chopping for over half an hour when, to my surprise, the old bird forced her way out, through the chips that had fallen into and partly blocked up the hole; there were three partly incubated eggs in this nest. Occasionally they nest in holes in stone walls and buildings.

At Hyderabad, Sind, their favourite nesting place is in the bulb at the top of the iron lamp posts in camp, a locality I should never have suspected, had it not been for Colonel Butler's remarks to the same effect in *Stray Feathers*. It was a difficult matter to get at the eggs, but by means of an old crooked spoon, I used to manage it; the nests are composed of grass and straw; the eggs, three in number, are moderately elongated ovals in shape, pointed a little at one end, and are much smaller than those of the common sparrow, much more so than the relative size of the birds would seem to warrant.

They measure 0·73 inches in length by about 0·54 in breadth. I have not noticed any great variation in size. They are greenish-white in colour, streaked and blotched with purplish-brown, sometimes almost black. Occasionally an egg may be found that is fairly light, but as a rule they are dull, dingy, brownish-black, the markings being so thick and dense that very little of the ground colour is visible.

720*bis*.—THE STRIOLATED BUNTING,

Emberiza striolata, *Licht.*

I have only once met with this bird, and that was on a bare stony hill-side about fifteen miles from Neemuch. The bird was sitting on an empty nest, which was placed under the shelter afforded by a clod of earth. It was composed at the bottom of small twigs and grass roots, lined with fine grass and a few feathers.

I had the spot carefully marked, and a week later, I sent a native who was with me when I found it, back for the eggs, but he somehow managed to smash them all. They were three in number.

Mr. Hume, in "*Nests and Eggs of Indian Birds,*" page 463, gives a good account of the nesting of this bird, which is too long to quote here; he found it to be a permanent resident of, and breeding in, the bare stony hills of Rajputana and Northern and Western Punjab; also rarely in the hills dividing Sind from Khelat.

He describes the eggs as being regular, moderately broad ovals, slightly compressed towards one end, but somewhat obtuse at both. The shells were very delicate and had a slight gloss. The ground colour differed somewhat in all three of the first eggs he took, in one it was pale greenish-, in another pale bluish-, and in the third faintly brownish-white. All were spotted, speckled, and minutely, but not very densely, freckled with brown; a sort of reddish-olive-brown in two, rather more of umber in the third; small clouds, blotches, and streaks of the same colour and of a pale purple were intermixed with the finer markings. In two of the eggs the markings were far more numerous towards the large end, where in one they are partially confluent; on the third they are pretty evenly distributed over the whole surface, being however rather denser in a broad irregular zone round the middle of the egg.

Near Neemuch, 15th October, Nest only. *H. E. Barnes.*

724.—THE CRESTED BLACK BUNTING.

Melophus melanicterus, Gm.

The Crested Black Bunting is common on the Aravelli Range, and also on the Khandesh Ghâts. It occurs near Baroda, and is far from uncommon close to Poona.

In all these places it is probably a permanent resident, breeding during the middle and latter part of the rains.

Within the limits of the Presidency, I have only found the nest at Aboo, but as I met with the bird during the rains, at the base of the hills near Poona, I feel sure that it breeds there also.

I know of no nest that is better concealed, and I have only been able to find it, by carefully watching the birds during the breeding season. I have often followed a bird, with a piece of grass in his beak, to within a yard or two of the nest, and even then it was only after a careful and painstaking search that I have discovered it.

It is usually placed in a hole or recess in a bank, and is, I believe, almost always well hidden by tufts of grass, clumps of ferns, or wild balsams. The nests differ a good deal: one I found, was a well-shaped cup, others were of a shallow saucer-shape, and one I found late in the season, was a mere pad. They are composed of grass roots and fibres, lined with hair and fine fern roots.

The eggs, three or four in number, as often one as the other, are of a broadish oval shape, measuring 0·79 inches in length by about 0·63 in breadth, but they vary a great deal in size.

In colour, they are greenish-, greyish-, or brownish-white, more or less densely speckled, spotted, and streaked with reddish- or purplish-brown.

I took a nest at Aboo, containing three unfledged nestlings, and caught both the parent birds in a cage trap; I had to leave for Deesa the same day, as my leave was up, and two of the nestlings died on the journey (there was no railway in those days), but the third, with the old birds, I confined in a cage, and fed them on grasshoppers and other insects, well pounded grass seeds, mixed with sopped bread and the yolks of eggs, hard-boiled. The old birds paid great attention to the little one, and they all soon became very tame, and either of them would take a grasshopper from my hand, and after bruising it a little, would give it to the nestling, refusing to eat themselves until his wants were supplied. After a time I transferred them all to the aviary, and when I left the station, eighteen months later, they were bold sprightly birds, the cock especially, and the note although simple was pleasant.

Mount Aboo, July and August.	*H. E. Barnes.*
Khondabhari Ghat, Khandesh, August.	*J. Davidson, C.S.*

756.—THE RED-WINGED BUSH LARK.

Mirafra erythroptera, Jerd.

The Red-winged Bush Lark is rare in Sind, having only been recorded from the plains at the foot of the hills that separate the province from Khelat. It appears to be altogether absent from the south-western portion of the Presidency, including Ratnagiri.

Its place in Kanara is taken by *Mirafra affinis*, but the latter is rare.

In all other parts it is common, but not ascending the hills to any great height.

They are permanent residents where they occur, breeding at least twice in the year, once during March and April, and again during August and September.

Some few nests may be found between these dates, but the majority breed at the times stated.

The nest, composed of grass stems and roots, is usually a mere pad, very seldom is there any attempt at a dome; it is usually placed under the shelter of a tussock of grass or clod of earth. Sometimes it is in a bare open plain, at others in grass or scattered bush jungle.

The eggs, three in number, often only two, are oval in shape, and are of a greenish-, or yellowish-white ground colour, thickly spotted and speckled with various shades of reddish-, and yellowish-brown, and pale inky purple.

They average 0·78 inches in length by about 0·56 in breadth.

Deesa, March and April,	*Aug. and September.*	*H. E. Barnes.*
Neemuch, *do.*	*do.*	*Do.*
Baroda, June.		*H. Littledale, B.A.*
Khandesh, June to October.		*J. Davidson, C.S.*
Nassick, *do.*		*Do.*

757.—THE SINGING BUSH LARK.

Mirafra cantillans, Jerd.

The Singing Bush Lark has been recorded from Deesa, Neemuch, and Western Khandesh; it doubtless occurs at other places within the Presidency, but it is very locally distributed and not very common anywhere.

So far as I know they are permanent residents where they occur, breeding like the preceding twice a year. The nests are composed of dry roots and grass, and all that I have seen have been domed, those found in the rains more perfectly so. They are usually placed on the ground, amongst thin scrubby patches of *Ber* bushes, that form so special a feature in the sandy and stony plains in these districts.

The eggs, from two to four in number, are longish ovals in shape, measuring 0·73 inches in length by 0·58 in breadth; the ground colour is greenish-, greyish-, or yellowish-white, thickly sprinkled, speckled, and spotted with yellowish and sepia brown, having underlying spots of faint inky-purple,

A bird I snared on the nest, in Deesa, laid an egg in the cage on the following morning; she did not get used to confinement, and was as wild a week after I caught her as she was on the first day, so I released her.

Deesa, April and August. — *H. E. Barnes.*
Neemuch, August. — *Do.*

758.—THE RUFOUS-TAILED FINCH LARK.

Ammomanes phœnicura, Frankl.

The Rufous-tailed Finch Lark does not occur in Sind, being replaced there by the Pale Rufous Finch Lark (*Ammomanes deserti*). Mr. Davidson has never seen this bird in Kanara, and expects it to be quite absent from the Konkan. It is a bird of the plains and does not frequent the higher hills or better wooded districts in the plains; in all other places it is a common permanent resident.

The breeding season commences about March, and continues through April to quite the middle of May; the nests are slight pads, composed of grass stems and roots, scantily lined at times with a few hairs. It is placed on the ground, in a cavity under a clod of earth or stone; the nest is usually below the surface of the ground. The eggs, usually three, occasionally four (I once found five), are moderately long ovals in shape, pinched in a little at one end, and measure 0·85 inches in length by about 0·62 in breadth. In colour they are usually yellowish- or creamy-white, spotted and freckled with yellowish- or reddish-brown, with occasionally a few pale inky-purple spots intermixed. They are very variable in size, shape, and colour. Mr. Hume gives the size as varying from 0·77 to 0·95 inches in length, and from 0·65 to 0·75 in breadth.

One clutch I found had the ground colour a pure white, with just a few yellowish-brown specks at the large end.

Deesa, March, April and May.	*H. E. Barnes.*
Neemuch, April and May.	*Do.*
Sholapur, March and April.	*J. Davidson, C. S.*
Khandesh, February and March.	*Do.*
Nassick, do.	*Do.*

759.—THE PALE RUFOUS FINCH LARK.

Ammomanes deserti, Licht.

The Pale Rufous or Desert Finch Lark is common on the bare rocky hills of Sind, breeding during the months of April, May and June. I have never met with a nest myself, but a good description of both nest and eggs is given by Mr. Hume in his *Nests and Eggs of Indian Birds.* The nests are said to resemble those of the Black-bellied Finch Lark (*Pyrrhulauda grisea*), but to be much larger. The eggs, three in number, are very regular ovals; they have a faint gloss, and the shell is fine and smooth. "The ground colour is white, with a scarcely perceptible brownish, greyish, or greenish tint, varying in different eggs, and they are speckled and spotted with pale yellowish-brown, more thickly so at the larger end, where they have a tendency to form an irregular cap or zone; where the markings are most dense, there are usually a few tiny clouds or spots of pale lilac. They vary a great deal in size, but the average appears to be rather more than 0·82 inches in length by 0·6 in breadth.

760.—THE BLACK-BELLIED FINCH LARK.

Pyrrhulauda grisea, Scop.

The Black-bellied Finch Lark is common throughout the Presidency, frequenting the bare open plains but eschewing the forest tracts. They seem to breed at all seasons, as I have taken eggs in each month of the year, with the exception of July and August, but February and March are, I believe, the months in which most nests will be found. They are small and saucer-shaped. Sometimes it is a mere pad, with a depression in the centre for the eggs; others are much more carefully made, and are tiny cups, small even for the size of the bird. It is placed on the ground, usually on the side of a small stone, clod of earth, or tuft of grass; sometimes in a hoof print without any shelter; should the depression in which it is placed be too shallow, they arrange a small row of pebbles, not so large as marbles, round the edge, to increase the depth. The nest is composed of fine grass, fibres, and goat's hair.

The eggs, two in number (once only have I found three), are longish ovals in shape, pinched in at one end, and are of a yellowish- or greyish-white ground colour, densely marked with spots, specks, and streaks of earthy- and yellowish-brown. They average about

0·78 inches in length, by rather less than 0·55 in breadth. If confined in a small cage, they seem very restless and unhappy, but a pair I kept in a large aviary seemed quite contented, and soon became fairly tame.

760.—THE BLACK-CROWNED FINCH LARK.

Pyrrhulauda melanauchen, Cab.

Within our limits the Black-crowned Finch Lark seems confined to Sind. Mr. Doig, who found them breeding there, says:—"This bird, wherever there are sand drifts, is very common, and is never, so far as my experience goes, found in company with *Pyrrhulauda grisea*; they breed at the end of February and beginning of March, at the end of May and commencement of June, and again in the end of August and beginning of September. One breeding ground I found in this latter month, was situated away from the Narra, some ten miles out in the desert, near some salt deposits, and where rain had evidently fallen, as there was a considerable growth of grass. The nests were very similar to those of *Pyrrhulauda grisea* both in size and description, and were invariably placed at the root of some tuft of grass, on the north side, evidently to shelter it from the hot wind. In this place I collected over forty eggs. They are very similar to those of *P. grisea,* perhaps as a rule more boldly marked, and some of them had well-defined rings of colour round the larger end. The normal number of eggs is two.

761.—THE SHORT-TOED OR SOCIAL LARK.

Calendrella brachydactyla, Leisl.

Mr. J. A. Murray, in his *Handbook to the Geology, Botany, and Zoology of Sind,* page 188, says:—"Common everywhere on the plains of Sind, breeding in April and May"; and again in his "*Vertebrate Zoology of Sind,*" he says:—"Breeds in April and May." I think this is a mistake. I feel sure that the Social Lark breeds nowhere within our limits. If it does, it is strange that Mr. Doig, Captain (now Colonel) Butler, or myself, never found a nest.

762*ter*.—THE INDUS SAND LARK.

Alaudula adamsi, Hume.

The Indus Sand Lark is not uncommon along the banks of the river, near Hyderabad. The only nest (at least I think it was this, but I cannot be sure as I did not see the parent birds), was placed at the side of a small bush in a depression in the sand: it was a very slight structure, composed of fine grass, and contained a single addled egg, which I unfortunately broke in trying to clean it.

Mr. Hume describes the eggs as being dull white in colour, spotted and mottled all over, but more thickly at the larger end, with pale greenish-brown; with a few spots of grey intermixed with the brown ones also at the larger end.

Three eggs varied from 0·78 to 0·8 inches in length and from 0·55 to 0·57 in breadth.

Hyderabad, Sind, April 5th. *H. E. Barnes.*

765.—THE SMALL CROWN-CREST LARK.

Spizalauda deva, Sykes.

The Small Crown-crest Lark is common in the Deccan, Khandeish, and Rajputana districts.

They are permanent residents, breeding during the rains, in July and August.

The nest is placed on the ground, in the centre of or under the shelter of a patch of scrubby *Ber* bushes, crowning a small mound; this prevents it from getting flooded during wet weather, sometimes the nest is placed under a tussock of grass; it is composed of grass-stems, roots, and vegetable fibres, and is of a shallow saucer-shape.

The eggs, two or three in number, as often one as the other, are oval in shape, pinched in a good deal at one end, and measure 0·8 inches in length by about 0·55 in breadth. They are rather glossy, and are dingy white in colour, profusely spotted and speckled with yellowish and earthy brown.

These markings are as a rule not very clear.

Neemuch, July to August.	*H. E. Barnes.*
Saugor, do.	*Do.*
Baroda, August.	*H. Littledale, B.A.*
Sholapore, July to September.	*J. Davidson, C.S.*
Khandeish, do.	*Do.*
Nassick, do.	*Do.*

765*bis*.—THE LARGE CROWN-CREST LARK.

Spizalauda malabarica, Scop.

I am indebted to Mr. Davidson, C.S., for the following note:—

"This is the common lark in Kanara, being found in abundance on the coast, and also in the fields, among the jungle above the ghâts.

"In Nassick itself I noticed it occasionally in the rains and in the hot weather; it was fairly common on the plateau of the Saptashring line of hills in that district, but I never noticed it at that season anywhere else, and it was there distinctly local.

"It makes its nest on the bare ground, but lines it generally fairly well, and usually lays two, rarely three, eggs of a pale greenish-grey, mottled with darker shades of the same; they vary considerably in size, but are much larger than those of *Spizalauda deva*, and are also I think as a rule much lighter in colour."

The eggs in my collection, given to me by Mr. Davidson, measure 0·85 inches in length by rather more than 0·65 in breadth.

Saptashring, Nassick, 1st week in April. *J. Davidson, C.S.*
Kanara, February, March, April and December. *Do.*

767.—THE INDIAN SKYLARK.

Alauda gulgula, Franke.

The Indian Skylark occurs in suitable places, throughout Western India; it is, however, very locally distributed, and I believe often overlooked. It is a permanent resident, commencing to breed early in May, and nests are to be found up to the end of July. I think they have at least two broods in the season, but do not lay again in the same nest.

The nest is not very elaborate as a rule, being merely a depression in the ground, scantily lined with fine grass, under the shelter of a clod of earth, or a tuft of grass; this hole is usually scratched by the birds themselves.

The eggs, two or three in number (I have never found more, but others speak of finding four and five), are of two different types; one is a dingy- or greyish-white, sometimes nearly pure, densely spotted and speckled with yellowish- and greyish-brown, with an occasional speck or spot of pale inky-purple or purplish-brown; the other has a creamy white-coloured ground, and the markings are not so dark or so thickly set; between these two types every possible combination occurs.

As a rule the markings consist of specks and tiny spots; occasionally an egg is found in which the markings are larger and bolder. In shape the eggs are moderately broad ovals, pinched in a little at one end, and average about 0·8 inches in length, by rather more than 0·6 in breadth. They are subject to much variation.

Deesa, 15th May to 29th June. *H. E. Barnes.*
Neemuch, 22nd July. *Do.*
Baroda, 23rd April to 28th June. *H. Littledale, B. A.*

769.—THE LARGE CRESTED LARK.

Galerita cristata, Lin.

The Large-crested Lark is a common permanent resident in Sind. It occurs not uncommonly in Northern Guzerat, where, however, I do not think it remains to breed. The nesting season lasts from the middle of March up to the end of June. The nest, which is usually cup-shaped (occasionally a mere pad), is placed in a hollow in the ground, much in the same way as those of other larks, under the shelter of a tussock of grass, or in the centre of a small scrubby patch of tamarisk or wild caper bush. All the nests I have seen have been more or less well lined with fine grass, the outside being composed of grass somewhat coarser. The eggs, three in number, are dingy-white in colour, spotted, speckled, and blotched with yellowish and purplish brown.

These markings predominate at the larger end, not unfrequently forming an imperfect cap, or zone. They vary greatly in size. Mr. Hume gives the length as ranging from 0·85 to 0·92, and the breadth from 0·65 to 0·69.

Hyderabad, Sind, March to June. *H. E. Barnes.*
Eastern Narra, Sind, April to May. *S. B. Doig.*

770.—THE DESERT FINCH LARK.

Alæmon desertorum, Stan.

The Desert Finch Lark occurs in the broad sandy strip of desert at the foot of the hills that divides Sind from Khelat; even here it is somewhat rare.

Mr. Doig found a nest between Hyderabad and the Narra. He says, *Stray Feathers*, Vol. IX., p. 280 :—" On the 3rd of June I found a nest and young of this species, on a large open plain, on the borders between the Narra and Hyderabad districts. Since then I have to thank my friend, Mr. Ffinch, for an egg of this bird, taken at Jask ; the nest I found was similar to those of *Pyrrhulauda grisea*, but larger. The egg in my collection is in markings very similar to those of *Pyrrhulauda melanauchen*, the markings being bolder, and the egg twice the size."

773.—THE SOUTHERN GREEN PIGEON.

Crocopus chlorigaster, Blyth.

The Southern Green Pigeon occurs more or less commonly throughout Western India, with the exception of Sind, where it is rare, having only been recorded from the frontier near Jacobabad.

I think they have two broods in the year, the first in the early part of the hot weather in March, and the other in May. The nests are, as a rule, placed in forks in trees, at heights varying from ten to twenty feet from the ground ; they are mere pads composed of a few sticks, laid crossways ; the eggs, always two in number, are glossy white ovals, measuring from 1·12 to 1·35 inches in length, and from 0·9 to 1·0 inch in breadth, the average being 1·25 by 0·95. These measurements are taken from Mr. Hume's "Nests and Eggs," those in my collection being too few in number to furnish a reliable average.

The birds sit very close, especially when the eggs are much incubated, so close that I caught the bird on the first nest I found.

Anadra (plains near Abu), March and May.		*H. E. Barnes.*
Neemuch,	*June.*	*Do.*
Khandeish,	*March to May.*	*J. Davidson, C.S.*
Nassick Jungles,	*Do.*	*Do.*
Kanara (above the Ghâts),	*May.*	*Do.*

774.—THE ORANGE-BREASTED GREEN PIGEON.

Osmotreron bicincta, Jerd.

This and the three following notes have kindly been furnished to me by Mr. Davidson, C.S.

"This is a very common bird *below ghâts* in Kanara, and I have noticed it from November to the end of May, so it must breed in the district. I have, however, never been able to find its nest."

775.—THE ASHY-HEADED GREEN PIGEON.

Osmotreron malabarica, Jerd.

"This is much the commonest Green Pigeon in Kanara, and indeed practically one sees dozens every day, both above and below the ghâts, the red back of the male being very easily noticed. I have taken numbers of the nests, which are slight structures generally placed from 8 to 15 feet from the ground, and mostly in small trees. The male is quite as commonly seen incubating the eggs as the female. Eggs taken from January to March."

780.—THE GREEN IMPERIAL PIGEON.

Carpophaga œnea, Lin.

"This bird is fairly common in all the evergreen jungles in Kanara above the ghâts, though I do not recollect to have seen it below the ghâts; these Imperial Pigeons are however shy and difficult to shoot, and on the wing they are barely distinguishable from each other; their notes do differ considerably, and that is the main clue as to which kind is about.

"The only nest I took was an ordinary dove's nest, fairly solid, and contained one very large pure white egg. It was taken on the 25th February, but I shot another on the 30th April, containing an egg which would have been laid in forty-eight hours, so they probably breed throughout the hot weather."

781.—THE BRONZE-BACKED IMPERIAL PIGEON.

Carpophaga insignis, Hodgs.

"This is a permanent resident in Kanara, as I have seen it at all seasons. It is fairly distributed throughout all the thick evergreen jungle below the ghâts, also on the ridge, and for a mile or two further east. It may be found elsewhere, but though I have seen the two species close to the ridge of the ghâts, I have never noticed this bird further east below the ghâts. The only nest I took was very similar to the last, and contained a single fresh egg; it was taken just below the ridge of the ghâts on the 13th February."

788.—THE BLUE ROCK PIGEON.

Columba intermedia, Strickl.

The Blue Rock Pigeon is a common permanent resident throughout the Presidency, breeding from November to May (these are the only months in which I have taken eggs), a favourite nesting place is in a hole, or on a ledge in a well.

The eggs, two in number, average 1·5 inches in length, by about 1·15 in breadth. They are too well known to need description.

788.—THE ROCK DOVE.

Columba livia, Bp.

The Rock Dove is said to breed on the rocky hills on the borders of Sind.

792.—THE ASHY TURTLE DOVE.

Turtur pulchratus, Hodgs.

793.—THE RUFOUS TURTLE DOVE.

Turtur meena, Sykes.

I am indebted to Mr. Davidson for the following note:—

" Ornithologists seem to agree that these species are distinct, but perhaps from not having typical specimens to compare others with, I think it rather doubtful. The distinction relied on appears to be the colour of the under tail coverts; these are said to be white in *pulchratus* and grey in *meena*.

" Now in West Khandeish I have shot right and left specimens, one of which had white under tail coverts and the other grey, and I have seen others that I could hardly say whether the coverts were pure white or greyish-white. I did not think the birds bred anywhere in this Presidency, though I remember natives telling me years ago they did in the Satara ghấts; but a few days ago, I startled a bird off a slight nest in a bamboo clump, or within a foot of it (for I did not see it sitting on the nest); it contained one egg as large as that of *Crocopus chlorigaster*, and a good deal bigger than that of *Osmotreron malabarica* or *Turtur suratensis*, the only other resident birds it could belong to. As I had a rifle in my hand, I could not decide whether its owner was the *pulchratus* or *meena* form."

I would add to this that I have shot moulting birds, with the new under tail coverts white, and the old ones grey.

794.—THE LITTLE BROWN DOVE.

Turtur senegalensis, Lin.

The Brown Dove is common throughout Western India, with the exception of Ratnagiri and Kanara,* where it appears to be a very rare straggler. They are permanent residents, breeding all through the year. I find from my notes that there is not a single month in which I have not taken eggs, in one district or the other. March and September are months in which most eggs are to be found.

The nest is usually placed in a bush or small acacia tree, in a cactus hedge, young date palm, and occasionally on the top of a pillar in a verandah; it is a small platform of twigs and dry grass stems, and the eggs, two in number, are rather broad ovals in shape, measuring an inch in length by 0·86 in breadth; they are of a pure white colour.

If the eggs are taken, they will lay a second, or even a third time in the same nest. If unmolested they often rear a second brood in the same nest.

795.—THE SPOTTED DOVE.

Turtur suratensis, Gm.

This is the common dove of Ratnagiri and Kanara, being equally abundant both above and below the ghâts, where it appears to replace the Little Brown Dove. In Sind it is rare, only occurring as a straggler, in the upper portion of the province. In all other parts of the Presidency it is more or less common in suitable places, but it is however somewhat locally distributed. It avoids dry sandy plains and places where the rainfall is scanty.

They breed at almost all seasons, but the best month to search for eggs are August and September. The nest is a scanty platform of small twigs and dry grass stems, placed on a cactus or other low bush; I have never found a nest at any great height from the ground. The bird is a very close sitter, even before an egg is laid.

The eggs, two in number, are pure glossy white; in shape they are broadish ovals, but vary greatly in size, but the average of a large series was 1·1 inches in length by 0·82 in breadth.

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* Davidson has never seen a specimen in Kanara, either above or below the ghâts.

796.—THE RING DOVE.

Turtur risorius, Lin.

This dove is common everywhere, except in the south-west, where it becomes comparatively rare.* Like the other doves it seems to breed at all seasons, rearing successive broods in the same nest, which is usually placed on a bush or low tree, at various heights from the ground. The nest is generally a frail platform of small twigs and grass stems, and the eggs, two in number, are broad glossy white ovals, averaging 1·16 inches in length, by 0·92 in breadth.

797.—THE RUDDY RING DOVE.

Turtur tranquebaricus, Lin.

This is the most locally distributed of all our resident doves; it occurs throughout Western India, but is decidedly rare in Ratnagiri. In some places it is very common, and in an adjoining district, apparently equally suitable, not one will be seen.

I have taken nests both before and after the rains, but I think the majority of them breed just after the rains. I have always found the nests, in small trees, well in the jungle, acacia trees for preference. The nest is very frail, and the eggs are usually visible from beneath. I have taken the eggs from old crow nests, and once found a nest built in the foundation of a Tawny Eagle's nest, which had on the opposite side a nest of the Common Munia.

The eggs, two in number, are oval in shape, measuring about an inch in length by nearly 0·79 in breadth. They are not pure white, but have a distinct ivory tint.

Mr. Davidson sends me the following interesting note:—

"This bird is more or less migratory. About Dhulia it was very common in the rains, but disappeared after, only a very few remaining to breed. It was then found at the base of the Sátpuras, in the jungles, all the hot weather. I have never noticed it in Kanara."

798.—THE BRONZE-WINGED DOVE.

Chalcophaps indica, Lin.

Mr. Davidson says:—"This lovely little bird is found occasionally along the ghàts, at all events as far north as Matheran. It is common in Kanara, both above and below the ghâts, but it is shy, and haunts as a rule thick evergreen jungles. It, however, has a habit of feeding on the roads passing through the jungle, and on most of these, a pair or so will be seen every half mile. It is a permanent resident, but I have never taken the nest, though one bird I shot in February would have laid in a couple of days."

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* Mr. Davidson has only met with one bird in the extreme east of Kanara.

799.—THE LARGE OR BLACK-BELLIED SAND GROUSE.

Pterocles arenarius, Pall.

During the winter months, the Large Sand Grouse occurs in Sind, Guzerat and Rajputana. Speaking generally, they are not uncommon in the more northern portions of Western India, becoming more and more rare towards the central parts, and quite disappearing from the south. No satisfactory evidence of their breeding within the Presidency exists, though birds have occasionally been shot as late as the middle of May.

One I procured on the plains of Meani, near Hydrabad, Sind, on the 20th of that month, had the ovaries much developed, and I believe that the eggs would have been laid in ten or twelve days. I saw a pair, but could only procure the female. Further north, in Southern Afghanistan, on the plains between Chaman and Gatai, I found them breeding plentifully during May and June. The eggs, three in number, were placed in a small depression in the soil, scratched by the birds themselves. They are of a long cylindrical shape, obtuse at each end. The shell is compact, firm, and glossy. The ground colour is a very pale green or greenish-white (those in my collection have now faded to a pale drab or stone colour); they are covered more or less thickly with spots and blotches of pale-yellowish and purplish-grey.

Mr. Hume, to whom I sent an egg, has thus described it:—

"The egg is a very elongated, cylindrical, dumpy, sausage-like egg, the shell is extremely fine and compact, and has a fine gloss. The ground colour is a very pale green or greenish-white, and it is moderately thickly studded with irregular spots and small blotches, more or less streaky in shape, of a rather pale yellowish-brown, and very pale, slightly purplish-grey. It measures 1·84 inches in length, by rather more than 1·35 in breadth.

800.—THE PAINTED SAND GROUSE.

Pterocles fasciatus, Scop.

With the exception of Sind in the north and Ratnagiri in the south, the Painted Sand Grouse occurs, more or less rarely, in suitable localities throughout the rest of the Presidency. It affects thin scant jungle at the foot of low rocky hills; they are, I believe, permanent residents where they occur, breeding as a rule during April and May, but eggs are occasionally found during the cold season.

They scratch a slight depression in the soil, under the shelter of a tuft of grass, and in this, without any lining, they lay two or three eggs, of an elongated shape, rounded at both ends, measuring 1·4 inches in length, by about 0·98 in breadth; they are of a glossy pinkish-fawn or pale salmon colour, speckled, spotted, and streaked with brownish-red and clouds of pale inky-purple intermingled.

To this, Mr. Davidson adds the following:—

"I would hardly call this bird common anywhere. It does not, I think, occur in Kanara or the Konkan. It is, I think, a very local bird everywhere, restricted to low scrub jungle. I know of its occurrence in one or two places in the Poona district; I have met with it at only two places during the four years I was in Sholapur. In West Khandeish and some parts of the north-east of Nassick it was moderately common, but that would only mean that perhaps five or six pairs would be seen in a morning's beating. I think it breeds pretty well at all seasons, except the three heavy rain months, July, August and September, and out of some fifteen or twenty nests I must have seen, almost all contained three eggs. I have taken eggs in the Khandeish and Nassick districts in October, December, January, February, March and May, up to the very end of the month."

801.—THE LARGE PIN-TAILED GROUSE.

Pterocles alchata, Lin.

The Large Pin-tailed or White-bellied Sand Grouse is confined to Sind, and even there is not common. I have only met with it at Jeempeer, between Hyderabad and Karachi.

Further north in Southern Afghanistan it occurs in immense flocks.

An egg, said to belong to *Pterocles arenarius* (the Black-bellied Sand Grouse), but which Mr. Hume believes to really belong to *Pterocles alchata*, was found at this place. He says:—" It is decidedly a shorter egg, it has much less gloss, the ground colour is a pale *cafe-au-lait*, the markings are of the same colours as on the other egg, but they are more thinly set, and the bulk of them much smaller; but then there are a couple of great large splashes of both the yellowish-brown and the purplish-grey, which far excel in size anything on the other egg. This egg measures only 1·7 by 1·2."

Undoubted eggs of the White-bellied Sand Grouse, which have been sent me from Persia, are larger than any I have seen of *arenarius*, measuring from 1·9 to rather more than 2·0 inches in length, and from 1·2 to 1·3 in breadth; in colour they are glossy pinkish-white, or pale salmon, and they are thickly and boldly spotted and blotched with bright reddish-brown and faint inky-purple.

They are very different eggs to those of *arenarius*, which are of the *exustus* type, while the present ones assimilate to that of *fasciatus*.

801*bis*.—THE SPOTTED SAND GROUSE.

Pterocles senegalus, Lin.

The Spotted Sand Grouse is not very common in Sind, and becomes more rare further south, and is only a mere straggler in Guzerat and Rajputana. All I can find on record regarding its nidification is contained in the following extract:—

"Nothing has ever been recorded of their nidification, but some, at any rate, do breed in Sind, as I possess an egg taken there.

"This single egg* I owe to Mr. William Blanford, who extracted it from the body of a female, which he shot on the 20th March, 1875, in the desert west of Shikarpur, Upper Sind. In shape and size the egg is similar to that of *exustus*, but the markings are much more sparse than in any egg of that species I have ever seen. The egg is, of course, cylindro-ovoidal; the ground colour is pale yellowish-stone, and the markings, which are thinly distributed over the surface of the egg, consist of olive-brown spots and tiny blotches, with a few crooked and hooked lines: besides these a few purplish-lilac or inky-grey spots, streaks, and smears having a sub-surface appearance, are scattered irregularly about the surface of the egg."

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* This egg is figured in the third plate of Eggs, Vol. III., Hume and Marshall's *Game Birds of India.*

"Having been extracted from the body of the bird, the egg has, of course, but little gloss. It measures 1·5 by 1·05."—*Hume's Game Birds*, Vol. I., page 55.

801*ter*.—THE CORONETTED SAND GROUSE.

Pterocles coronatus, Licht.

The Coronetted Sand Grouse, within our limits, has only been procured on the confines of Sind, and that but rarely. It is, I believe, only a cold-weather visitant, but further north, in Southern Afghanistan, I was so fortunate as to procure two batches of eggs.

One of these I took with my own hands, on the 30th April, shooting the female bird as she left the nest, and the male bird in the immediate vicinity.* The eggs, three in number, were placed in a depression in the ground, scratched by the birds themselves, without any attempt at concealment, in the middle of an open plain. They measured 1·5 inches in length by 1·06 in breadth. Another clutch, taken on the 27th May, was found in a precisely similar situation, but the eggs are somewhat larger; one of these I sent to Mr. Hume, which he thus describes in *Game Birds*, Vol. III., page 426:—

"One of these eggs, taken on the 27th May * * * has a fine and compact shell, and a moderate amount of gloss; the ground colour is a pale creamy-white, the markings, spots, moderate-sized blotches and streaks, are, as usual, of two colours, a pale rather washed-out yellowish-brown, and a very pale almost sepia-grey. This egg measures 1·63 by 1·07."

802.—THE COMMON SAND GROUSE.

Pterocles exustus, Tem.

The Common Sand Grouse, with the exception of Ratnagiri, occurs abundantly in suitable places throughout Western India. It does not affect hilly or rocky districts, nor is it found in forest or swampy places. It is very partial to fallow and ploughed land.

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* Both these skins were sent by me to the Frere Hall Museum, Karachi.

It is a permanent resident, breeding pretty nearly all the year through, but April and May are the months when most eggs are to be found. The eggs, three in number, are deposited in a slight depression on the ground; they are of the usual shape peculiar to the Grouse family, long and cylindrical, equally blunt at both ends; in colour they are greenish or greyish-white, or even light olive-brown, thickly streaked, blotched, and spotted, equally over the whole surface, with darker or lighter shades of olive-brown, and with pale underlying clouds of very pale inky-purple.

They average 1·45 inches in length by about 1·03 in breadth.

BOMBAY GRASSES.

By Dr. J. C. Lisboa, F.L.S.

PART III.

(*Continued from* p. *232, Vol. V.*)

(*Read at the Society's Meeting on 18th February* 1890.)

Setaria, *Beauv.*

S. glauca, Beauv., Agrost. 51; Kunth. Enum. I. 149; Dalz. and Gibs., *Bomb. Fl.* 293.

Vern. *Berdi, Gub, Bandra, Kangni, Pingi-natchi.*

Common in Guzerat, Poona, Nassick, Tanna, and all over India. Is a fairly good fodder grass, the seeds of which were used as food during the famine time.

A slender small variety is found all over Bombay, with yellow awn-like hairs surrounding the spikelets. It never grows large like the larger form of the type species. It is named at Mahableshwar and Poona "Kolara," Dalz. and Gib. *Bomb. Fl.*, and resembles *Setaria purpurascens,* Humb. and Kunth.

S. verticillata, Beauv., 51; Kunth. Enum. I. 152; Dalz. and Gibs., *Bomb. Fl.* 294.

Vern. *Lapti, Chirchira, Dora byara* (Roxb.)

Found all over the plains and ghâts, and eaten by cattle when young. The grain is used by the poorer classes as an article of food.

S. intermedia, R. and S. Syst. II. 489; Kunth. Enum. I. 150.

Vern. *Landgar, Chiriya-chana.*

Like the preceding this also is very common, and is met with all over the plains and ghâts.

S. macrostachya, H. B. and K., Nov. Gen. et Sp. I. 110.

This is rare. It was to be seen some years ago on the right of the road leading to Walkeshwar. The place has now been converted into a garden.

S. Italica, R. Brown.

Vern. *Kangni*, *Kora-kangi.*

The spikes of this resemble those of *Panicum frumentaceum.*

Though believed to have heating properties, this millet is esteemed in certain parts both for its supposed medicinal properties as well as for eating, being used in the form of cake and as porridge. Two varieties of it seem to exist, one straw-yellow and the other of a reddish-yellow colour. The straw is not much appreciated, being considered equal to rice straw as fodder for cattle.

CENCHRUS, *Linn.*

C. montanus, Nees in Royl. Ill.; *C. Schimperi*, Steud. Syn. Glum, III. ; *C. tripsacoides*, Fres.

Vern. *Anjan*, *Dhamman* (Duthie).

Common in the sandy plains of N.-W. India, and also found in Nassick and Guzerat. Duthie speaks of it as "one of the most nutritious of Indian grasses, and considered by some to be the very best." It makes hay of a very superior quality.

C. catharticus, Del.

The seed of this grass mixed with other kinds is used as food by the poorer classes. The foliage appears early, which makes it very valuable as forage; it is however unsuitable for stacking.

Found in Guzerat and in sandy soil in the N.-W. Provinces of India.

PENNISETUM.

P. Alopecuros, Steud. Syn. Glum. 102; *Gymnothrix Alopecurus*, Nees.

Vern. *Navaga.*

Met with at Poona, Lanowli, Nassick and in other districts, where it is not uncommon. In Poona brooms are said to be made of it, and at Mount Abu it is employed in the manufacture of cordage.

P. cenchroides, Rich (in Pers. Syn. I. 72); Steud. Syn. Glum. 105.

Found in Guzerat and the Deccan. Makes excellent fodder for cattle and horses, and is believed to be useful in increasing the milk of cows. In certain parts of India it is credited with having the property of giving a semi-intoxicating effect to the milk of buffaloes grazing on it.

P. lanuginosum, Hochst. Rich. *Fl. Abyss.* II. 385.

Found in the Deccan and Guzerat.

P. aureum, Link. Hort. I. 215; Dalz. and Gibs. *Bo. Fl.* p. 294.

Vern. *Mooltom.*

This grass has not been seen by me, though the authors of the *Bombay Flora* state it to be "common all over the Deccan and almost unknown to botanists."

P. typhoideum, Rich. in Pers. Syn. 72; *Pennicillaria spicata*, Willd.; *Holcus spicatus*, Linn.; Dalz and Gib. *Bo. Fl.*, Suppl. 99.

Vern. *Bajri.*

Figured in Church's "*Food Grains of India,*" and in "*Field and Garden Crops of N.-W. Provinces.*"

Bajri is too well-known a grain to require description. It forms the staple article of food of the poorer classes in the Deccan, Khandeish and Guzerat. It is also used in the Koncan on account of its being cheaper than rice which is exported. It is cultivated in various parts of India and Ceylon. The stalks and leaves are used as fodder.

Spinifex, Linn.

S. squarrosus, Linn., Kunth. Enum., Plant I. 175.

Vern. *Saranto* (Goa name).

Common along the Coast; also in Ceylon and Hongkong. Mr. Ferguson says:—"This is one of our most remarkable grasses, forming in some places belts along the sea-shore several miles in length. It is a truly littoral plant, and an excellent sand-binding one. When burnt it makes a crackling noise like salt thrown in the fire. When the seed is ripe, the large spherical head of the seed-bearing plant is detached and blown about the sands by the wind, and is supposed to illustrate in a remarkable manner 'the rolling thing before the whirlwind' of Isaiah xvii. 13, and 'the wheel before the wind' of Psalm lxxxiii. 13."

The following remarks on this plant occur in Emerson Tennent's "*History of Ceylon*," Vol. I., pp. 48-9:—

"Another plant which performs an important function in the fertilisation of these sand formations, is the *Spinifex squarrosus*, the "water-pink" as it is sometimes called by Europeans. The seeds of this plant are contained in a circular head, composed of a series of spine-like divisions which radiate from the stalk in all directions, making the diameter of the whole about 8 to 9 inches. When the seeds are mature and ready for dispersion, these heads become detached from the plant, and are carried by the wind with great velocity along the sands, over the surface of which they are impelled on their elastic spines. One of these balls may be followed by the eye for miles as it hurries along the level shore, dropping its seeds as it rolls, which speedily germinate and strike root where they fall. The globular beads are so buoyant as to float lightly on the water, and the uppermost spines acting as sails, they are thus carried across narrow estuaries to continue the process of embanking on newly-formed sand bars. Such an organisation irresistibly suggests the wonderful means ordained by Providence to spread this valuable plant along the barren beach to which no seed-devouring bird ever resorts; and even the unobservant natives, struck by its singular utility in resisting the encroachments of the sea, have recorded their admiration by conferring on it the name of Maha Rawana Rewula, 'the great beard of Rawana or Rama.'"

MAYDEÆ.

Coix, *Linn.*

C. lachryma, Linn., Sp. 1374; Dalz. and Gib. *Bo. Fl.* 289.

Vern. *Rand-jondhala*, *Rand-maka*, *Kassar*, *Kasdia*. *Gurgur* and *Kunch* in Bengal (*Roxb.*).

Very common. Eaten by cattle. The pounded seeds are used as an article of food by hill-tribes. The involucre, which is known here by the name of "Kassai-bij," is used in native medicine as a diuretic.

C. gigantea, Kœnig. MS. Roxb. *Fl. Ind.* III. 570.

Vern. Same as the preceding. *Kesai*. *Danga gurgur*, Bengal (*Roxb.*).

CHIONACHNE, *R. Br.*

C. barbata, R. Br. in Benn. Pl. Jav. Rar. 18; *Coix barbata*, Dalz. and Gibs. *Bomb. Fl.* 289.

Vern. *Varival, Karang, Kawdia*; Bengal *Gurgur* (Roxb.). Common on wet grounds. Said to be used as fodder at Balaghat.

EUCHLÆNA, *Schrad.*

E. luxurians, Ascheron.

Seen in gardens. A splendid fodder grass, the cultivation of which proves costly, as it requires a rich soil and abundance of water. Highly valued in certain parts of the United States.

ZEA, *Linn.*

This genus is represented by a single species. In a paper on the "Genera of Grasses," published in the Journal of the Linnean Society, Mr. Bentham says:—

"This most important, widely diffused and most striking grass is only known in a cultivated state, or perhaps as an escape from cultivation. With most of the general characters of the tribe to which it gives its name, it is exceptional not only in that tribe, but in the whole order by the manner in which its numerous female spikelets are densely packed in several vertical rows round a central spongy or corky axis. How far this arrangement may have gradually arisen after so many centuries of cultivation can only be a matter of conjecture."

Zea has never been known in an uncultivated state, and has long been believed to be a cultivated form of the last species, on account of the close resemblance of their flowers both in arrangement and structure. Indeed, Mr. Bentham has stated that this affinity of *Zea* to *Euchlæna* appears to be recognised in this country, for specimens have been received from Schaffner, purporting to be known as "wild maize."

Z. Mays, Linn.; Dalz. and Gibs. *Bo. Fl.*, Suppl. 100.

Vern. *Boota, Mocka*, Indian Corn.

Grown extensively in the early part of the rainy season, the cobs supplying a choice grain, which is seldom reduced to flour, being generally baked or roasted over a slow fire and consumed by the poor equally with the rich. It appears to have been introduced into this country from America, but has degenerated considerably in size, the largest being grown in Jaunpur and Azamgarh, the cobs in these districts being double the ordinary size, and the plants themselves taller than the ordinary.

Maize is grown both for the grain as well as for fodder; the stalks being rich in saccharine matter are gladly eaten by cattle. When required for fodder the sowing is very close and is carried on about the middle of March or April; but if cultivated for the sake of the grain, the sowing does not commence until the rains break.

ORYSEÆ, *Linn.*

ORYSA, *Linn.*

O. sativa, Linn., Dalz. and Gibs. *Bo. Fl.*, Suppl. 98.

Vern. *Chawal*, Rice.

The daily food of the natives of India, much cultivated in the Concan and Ghât districts of Guzerat. One to two crops are raised annually, but it is not uncommon in Canara and Malabar to raise three crops from the same ground.

A variety of wild rice is said to grow at Mount Abu, where it is collected for food by the natives.

Rice straw, though sometimes given to cattle, is not considered wholesome.

HYGRORYZA, *Nees.*

H. aristata. Nees in Edin., Phil. Journ.; *Potamchloa aristata*, Griff. in Journ. Asiat. Soc. and Icones Plant. As., t. 140.

Grows in the Konkan, and North Canara. Cattle are said to be fond of this grass.

LEERSIA, *Swart.*

L. hexandra. Swart. *Fl. Ind. Occid.* I. 131; *Zizania aristata*, Griff. in Journal Asiatic Soc., Beng., V. 570, t. 22.

Found in North Canara, and elsewhere on wet ground. According to Symmond cattle are fond of it; and in Australia it is said to be much relished by stock.

TRISTEGINEÆ.

ARUNDINELLA, *Raddi.*

A. stricta, Nees, Dalz. and Gibs., *Bomb. Fl.* 293.

This is given on the authority of the authors of the *Bombay Flora*, who do not describe minutely the characters of the glumes, and in the absence of the original specimens, it is not easy to distinguish it from *A. Nepalensis* or *A. setosa.*

A. Nepalensis, Trin., Sp. Gram. t. 268.

Vern. *Kotir, Dundee.*

Mahableshwar, Lanowli, Khandala and North Canara.

In the specimen before me, the branches of the panicle are distant from each other, and not closely clustered, as stated by Mr. Bentham in his description of the Australian plant.

It is not eaten by cattle.

A. (sp. nov.).

Culm 3—4 ft. long, slender, glabrous; leaves 1½ ft. long, pointed, rough and hairy by 4 lin.; ligule hairy; sheath glabrous, 4—5 in. long; panicle narrow, 1—1½ ft. long, dense or loose, erect or nodding; branches verticelled or semi-verticelled; spikelets geminate unequally pedicelled, one on a pedicel 4 lin. and the other on a pedicel 2—2½ lin., very narrow, about 1½ in. long. Common rachis ridged; partial rachis and pedicels with minute stiff hairs. Outer glume with a central more or less distinct nerve, a little shorter than the second, both pointed, and covered with numerous thin soft hairs; second glume with one central nerve and two lateral, almost indistinct; third glume thinner, as long or a line longer than the first, with a male flower in the axil, and a few hairs on the upper part of its back on the mesial line; fourth glume smaller, hyaline, with a fine twisted bent-back awn from the top, nearly double the length of the spikelet; palea small.

Vern. *Turdia, Kotir.*

Common in Poona, (?) at Lanowli, Khandalla and below the Ghâts. This is probably *A. gigantea,* Dalz and Gibs. *Bomb. Fl.*

Not eaten by cattle.

A. Ritchei, Munro, MSS.

A tall grass; culm 3—4 ft. long, glabrous smooth; nodes with or without a ring of short hairs; leaves 16 in. long by 5—6 lin. at the broadest part, pointed, glabrous, or minutely downy, with a few hairs at the inner base; ligula 1 line long, hairy; sheath longer than the nodes, glabrous, and generally about 8 in. long; spike (panicle) terminal, 1 ft. long or more, rather contracted; branches numerous, opposite or sometimes alternate, arising singly or 2 and 3 together; the lower 4-5 in. long, the upper shorter. The common rachis of the spike and of the branches ridged and scabrous from minute tubercles; spikelets mostly 2, both unequally pedicelled; pedicels not hairy, the longest pedicle 3 lin., shortest 1—1½ lin; spikelet nearly 2 lin., broadly ovate lanceolate; outer glume 1¼ lin. acute; nerves 3, the central more prominent with minute murications; 2nd glume 2 lin., a little shorter pointed, with five nerves, 3 more distinct; third glume thinner, broader and a little longer than the first, but shorter than the second, not distinctly nerved, with a male flower, and palea in the axil; fourth glume thin, transparent, smaller than the first, with an awn 2—2½ lin. long, arising from the undivided top; palia small and transparent. Hermaphrodite flower well formed.

This is called *A. Ritchei* from a specimen, thus named by Munro, kept in the herbarium of the Poona College of Science. The above description is mine.

Vern. *Kotir, Turdia.*

Common at Thana, Salsette and Lanowli.

It is not used as a fodder, nor is it of much use for grazing. When young, mixed with *Anthisteria polystachia*, Roxb., and *A. tremula*, Nees, it yields good *rab.*

A. mutica, Nees, MS. Steud Syn. Pl. Glum. I. 116.

All over Bombay.

The spikelets, like those of *Panicum myosurus*, are of a purple colour.

A. nervosa, Nees, Steud. Syn. Pl. Glum. I. 115; *Holcus nervosus*, Roxb. *Fl. Ind.* I. 318.

Poona, Coromandel, and also in Ceylon.

A. tuberculata, Munro MSS.

Culm simple, erect, or slightly decumbent at the base, 1—1¼ ft. long, glabrous; sheaths, leaves and spikelets densely clothed with white hairs, 1 lin. long, from a papilose or tuberculated base; sheaths 2—3 in. long, appressed, longer than the internodes; ligula very small, consisting chiefly of hairs; leaves 2½—2¾ in. by 2 lin. (lower shorter), linear-lanceolate, acuminate, rounded at the base, scabrous; panicle 5—5½ in. long; rachis angular, glabrous or minutely pubescent; branches or racemes alternate, 1 in. long or a little longer, the upper shorter; spikelets ovate-oblong, geminate, both of the same size, about 3¼ lin. long, including the awn-like point of the second glume, and both unequally pedicelled, one on a very short pedicel or almost sessile, and the other on a pedicel 1 lin. long. Outer glume chartaceous, acute, 1¾ lin. long, 3-nerved, nerves prominent and hairy; second glume chartaceous, broader, 3¼ lin., 5-nerved, hairy, specially at the lower ¾th part; 3rd glume obtuse, nearly equal to the first or outer glume, but broader and thinner; 5 indistinct nerves, no hairs; palea in the axil; fourth or flowering glume, a little smaller, thinner, transparent, with an awn arising from the top between two transparent bristles. The twisted part is brown, the straight whitish.

Poona and Konkan.

A specimen of this grass kept in the Herbarium of the Poona College of Science is thus named. It has great affinity to *A. pilosa*, Hockst., Steud. Syn. Pl. Glum. I. 116, if not the same.

The above description is mine.

A. purpurea, Hockst., Steud. Syn. Pl. Glum I. 115.

Received a specimen from the Konkan

A. tenella, Nees, MSS. Dalz. and Gibs. *Bombay Fl.* 292.

One of the commonest grasses at Mahableshwar, specially under the shade of the trees and shrub. Not cared for by cattle. Used as an ornament in bouquets in the dry state.

A. pumilla, Steud. Syn. Pl. Glum. t. 114. Rich, *Fl. Abyss* II. 414.

This elegant grass continues to be of a green colour even when dry.

At Lanowlee and Konkan and various part of India. Nothing is known about its uses.

A. avenacea, MSS., Thwaites, Enum. Pl. Zeylan.

A small elegant grass. Culms glabrous, slender, branching and rooting from the base, 3—5 in. long; nodes glabrous; sheath about ¾th in. long, appressed, sparingly pilose along the margins; ligula acuminated by a line, leaves 10—12 lin. long, ovate lanceolate, acute or minate, cordate at the base, amplexicaul, sparingly pilose, with rigid cilia at their origin from the sheath. Panicle erect, dense, or slightly spreading, about 1 in. long, consisting of very short racemes, densely congested on the top of 1—2 in. long glabrous peduncle; rachis minutely pubescent or sparingly hairy; spikelets lanceolate, 3 lin. long (exclusive of the long awn-like point of the 2nd glume), geminate, equal in size, but unequally pedicelled; outer glume 2 lin long, lanceolate, pointed, 3-nerved, with long hairs on the nerves; 2nd glume 3 lin. (exclusive of the point), 5 lin. long with the point, 3—5 nerved, with hairs on the nerves; 3rd glume 3 faintly-nerved, transparent, lanceolate, pointed, a little broader and longer than the first, with a large palea in the axil, no hairs; 4th glume smaller, half size of the 3rd, thin, transparent, with an awn 10 lin. long arising from the top between two thin hair-like processes, the lower part flat, contorted and dark-brown up to the knee, the upper bent part is round, whitish.

At the Western Ghâts and at Mahableshwar.

The above description is mine.

A. Campbelliana,* (Sp. nov.)

Culm erect, 4-8 in. long, very slender, glabrous, of purplish colour, nodes glabrous; leaves 1¼—1½ in. long by 2—3 lin., acute, glabrous, of straw colour; sheath glabrous, of purplish colour, striated, appressed, as long as the nodes; ligula small, not hairy. Inflorescence capitate, and consists of several small racemes, densely and closely congested at the upper part of the peduncle, and slightly exerted, (about half an inch) above the uppermost leaves. The general rachis is ribbed, about ¾ inch long, glabrous, partial rachis about 2 lin., also glabrous. Each raceme is about one-third in. long; and consists of 5 or 6 spikelets, which are single or occasionally geminate; first glume rigid, 2 lin. long, 3-ribbed, glabrous, with a few small scattered hairs on the middle rib; the second glume also rigid, 1-3 lin. long, including the point, with 3 or 5 ribs, 3 distinct, with very small murications; third a little smaller than the first, but broader than it, and the second, thin, rather transparent, with a few small hairs on the upper half of the middle line, the end is jagged, not drawn into a point, with a palea or occasionally a male flower; fourth smaller than the third, hyaline, with a slender geniculate awn, 4½ lin. long, twisted below the geniculation, arising between 2 fine setiform processes of the glume; palea smaller.

A small grass resembling at first sight *Apocopis filifolia*, or a variety of *Polypogon Montpeliense*. Not common. Grows at Mahableshwar: collected at the end of the rains in 1889. Uses not known.

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* *Arundinella Campelliana* is thus named in honour of Mr. J. M. Campbell, C. S., C.I.E., the editor of the *Bombay Gazetteer*, for his eminent services to the literature and archæology of this country, and in recognition of the favour of obtaining for me a large collection of grasses through the Forest Officers of various districts of Guzerat, Konkan and the Deccan, before the Bombay Government had passed the Resolution No. 521 on the 21st January, 1891, directing the three Conservators of Forests to supply me with specimens of grasses.

A. spicata. Dalz. in Dalz. and Gibs. *Bomb. Fl.* 293.

Common at Mahableshwar; also in Poona.

The inflorescence resembles that of *Setaria.*

TRICHOLÆNA, *Schrad.*

Tricholæna Wightii, Nees, MSS., *Panicum Megalanthum,* Stucd. Syn., Pl. Glum I., 93.

Culm slender, about 1½ ft. high or more, geniculate at the first or second node, hairy; sheath with bulbous hairs, striated, appressed up to about one inch of the node; nodes also hairy; ligula small, truncated, ciliated; leaves 5½ in. long, 2 lin. broad at the base, narrower and pointed at the end, the central line on the back broad and prominent; panicle 3—4 in. long, rather dense, branched at the lower part; the common rachis seldom or never excerted from the broad sheath of the highest leaf, very thin and glabrous; the rachis of the branches thinner and flexuose; peduncles of spikelets thready, glabrous, of various lengths, 4—5 lines long, tortuous, solitary or very seldom geminate; spikelets large, nearly 4 lin. long; the lower glume 1 lin. long, hairy, narrow, oblong, obtuse, and at a very short distance from the second glume; second glume 3 ribbed, 3—3¾ lin. long, clothed with long shining silky, lilac hairs, concealing a thin, small awn which arises from the two-dentate end; third glume similar to the second in every respect, except that it bears in its axil a male flower and palea; 4th glume smaller, broad, destitute of hairs, thin, opaque, and rather stiff, enclosing a hermaphrodite flower.

The above description is mine.

This beautiful grass with dense panicles of a pink or lilac colour grows at Mahableshwar, Panchgunny and the Western Ghâts. Also in Rajputana and Jeypore, where it is known by the name of *Bard* and *Giri.* Professor Hakel names it *Tricholæna tuberculosa* and Mr. Duthie now adopts this name, though in his brochure, "Fodder Grasses of Northern India," he described it under the name *Rhynchelytrum Wightii.**

THYSAHOLÆNA, *Nees.*

This genus contains the following single species :—

T. acarifera. N. act. N. C. XVII. Sup. I. 180; Steud Syn. Gram.

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* This grass ought to have come at the end of the description of the species of *Panicum.*

I. 119; *Panicum acariferum*. Trin. Sp. Gram. t. 87; *Melica latifolia*, Roxb. *Fl. Ind.* I. 328.

Cespitose; culm erect, simple, smooth, 4—8 ft. high, enveloped in the sheaths of the leaves; sheaths hairy at the mouth; ligula small, ciliate, lacerated; leaves lanceolate, rather attenuated at the base and pointed at the end, smooth, glabrous, rigid, 8—20 in. long by 1—4 in.; panicle terminal, about 2 ft. long, supra-decompound; branches and branchlets numerous, filiform, bearing subsessile spikelets; pedicels scabrous; spikelets lanceolate, ½ lin. long, solitary and geminate, unequally pedicillate; glumes lanceolate, acuminate, greenish; 1st glume shorter than the second, half the length or a little more; third glume longer than the second, acuminate, membranous, 3-nerved; fourth or flowering glume shorter and thinner than the third, linear lanceolate, ciliate; stamens 2—3; stigmas plumose.

It is a tall, elegant grass, especially when in flower. Not common. Grows at Thana, Nassick, East Khandeish and other parts of India; also in China and the Philippines. A specimen, named a species of bamboo, was received from Baroda. Handsome plants are seen in the Bombay University Gardens, where they flower in the months of March-April. They were introduced by the Hon'ble Mr. Justice Birdwood. Mr. Duthie says: "It is not uncommon on the plains and on low elevations on the hills, usually in the vicinity of water. The grass is called Kaisar in Chota Nagpur. A decoction of the root is used as a rinse for the mouth in cases of fever."—(Rev. A. Campbell.) In describing the leaves, Roxb. says: "they are much like the leaves employed by the Chinese to put between the boxes and lead canisters in which their teas are packed."

ZOYSICEÆ.

TRAGUS, *Hall.*

T. racemosa, Hall, Stirp. Helv. II., 203; Beauv. Agrost. t. 6, fig. 13. *Lappago racemosa*, Willd; *L. alienas*, Dalz. and Gib. *B. Fl.* 295; Sibth. *Fl. Græc.* t. 191; *L. biflora*, Roxb. *Fl. Ind.* I., 281.

A small nutritious grass, much grazed in the rains. Its small size makes it unfit for stacking. Considered good in Australia for winter feeding. Not favourably spoken of from certain parts of India.

Found in Surat, Domus, Sind, the Poona districts, Neera, &c.

PEROTIS, *Ait.*

P. latifolia, Ait., Kunth. Enum. 1., 470. Dalz. and Gibs. *Bo. Fl.* 296; *P. patula* and *P. longiflora*, Nees, Steud. Syn. Gram. 186; *P. hordeiformis*, Nees, and *P. glabrata*, Steud. Syn. Gram. (short-flowered variety), *Anthoxanthum Indicum*, Linn.

Seen by me at Damaun. Kanara specimens were received from Domus and Surat. Widely diffused over tropical and sub-tropical Asia and Africa, China, Japan, the Cape of Good Hope and Teneriffe.

ZOYSIA.

Z. pungens, Wildd., Kunth. Enum. t. 471; *Z. tenuifolia*, Wildd.

Z. Japonica, Steud. Syn. Gram. 414; *Z. Griffithiana*, C. Mull in Bot. Zeit.

A common seaside plant growing in tropical and sub-tropical Asia, Australia and Japan. My specimen came from Damaun.

It is a small plant with stiff pungent leaves and needle-like spike of flowers. It creeps to a great length, and serves to bind the sands along the coast.

NOTES ON THE LARVÆ AND PUPÆ OF SOME OF THE BUTTERFLIES OF THE BOMBAY PRESIDENCY.

BY J. DAVIDSON, BO. C. S., AND E. H. AITKEN.

(Continued from page 278.)

(With Plates D, E, and F.)

THE publication of our notes has been delayed by various causes, and this second part has had the benefit of another season's experience. This has been a very great advantage. Last year's observations have been verified, or corrected, and many deficiencies have been made up, while ten new species have been added to the list. Great efforts were made to find more larvæ of *Kallima horsfieldii*, but only two were obtained. Comparison of these with the larvæ of *Hipolymnas bolina*, for which we mistook our first specimen, showed some differences by which it is not difficult to distinguish them irrespective of colour. The spines on the head of *Kallima* are decidedly longer, while those on the body are smaller and finer than those of *Hipolymnas*. The pupæ also are distinguishable by the contour of the thorax, but the difference is very slight. In the first part of our notes we said that we had only bred the small form of *H. bolina*, and had not ascertained its food-plant. During the past season we obtained many larvæ on a species of nettle (*Fleurya interrupta*),and reared both forms from them. One curious fact which escaped our notice till this season, and which we have not seen mentioned elsewhere, ought to be noted here. It is that the spines of *Euthalia* are epidermal and are shed at each moult, the larvæ emerging with only a row of small, blunt processes, which in a very short time expand into spines. We will now resume our notes, but first we must express our grateful thanks to Mr. Lionel de Nicéville for naming all our *Hesperiidæ* and giving us much assistance in other ways, and to Mr. T. R. Bell, of the Forest Department, whose skill in finding larvæ is only equalled by the generosity with which he lets others reap the fruits of his labours.

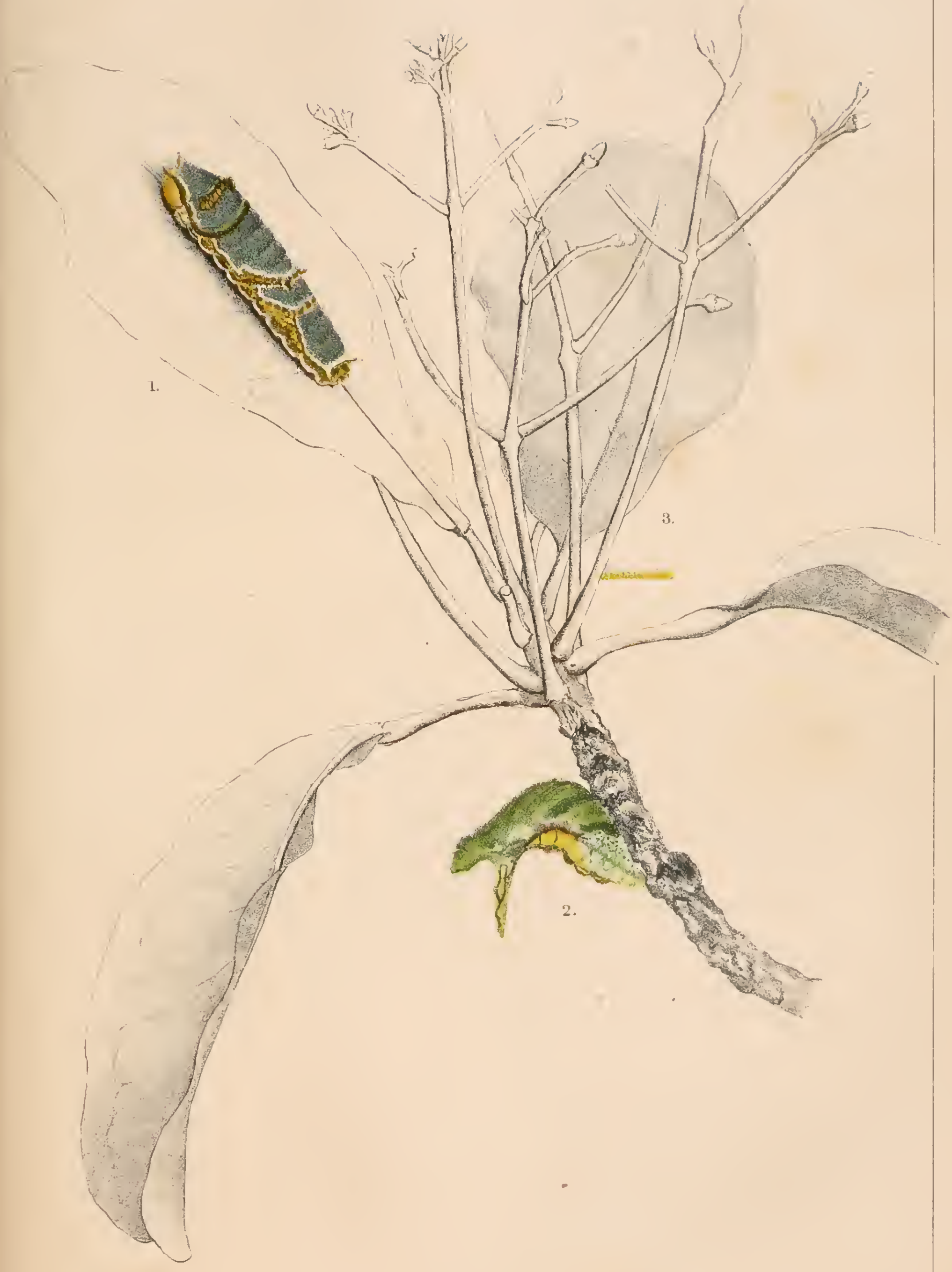
The larvæ of the following *Nymphalidæ* have been discovered since the first part of our paper was in print.

41. *Lethe europa*, Fabricius.

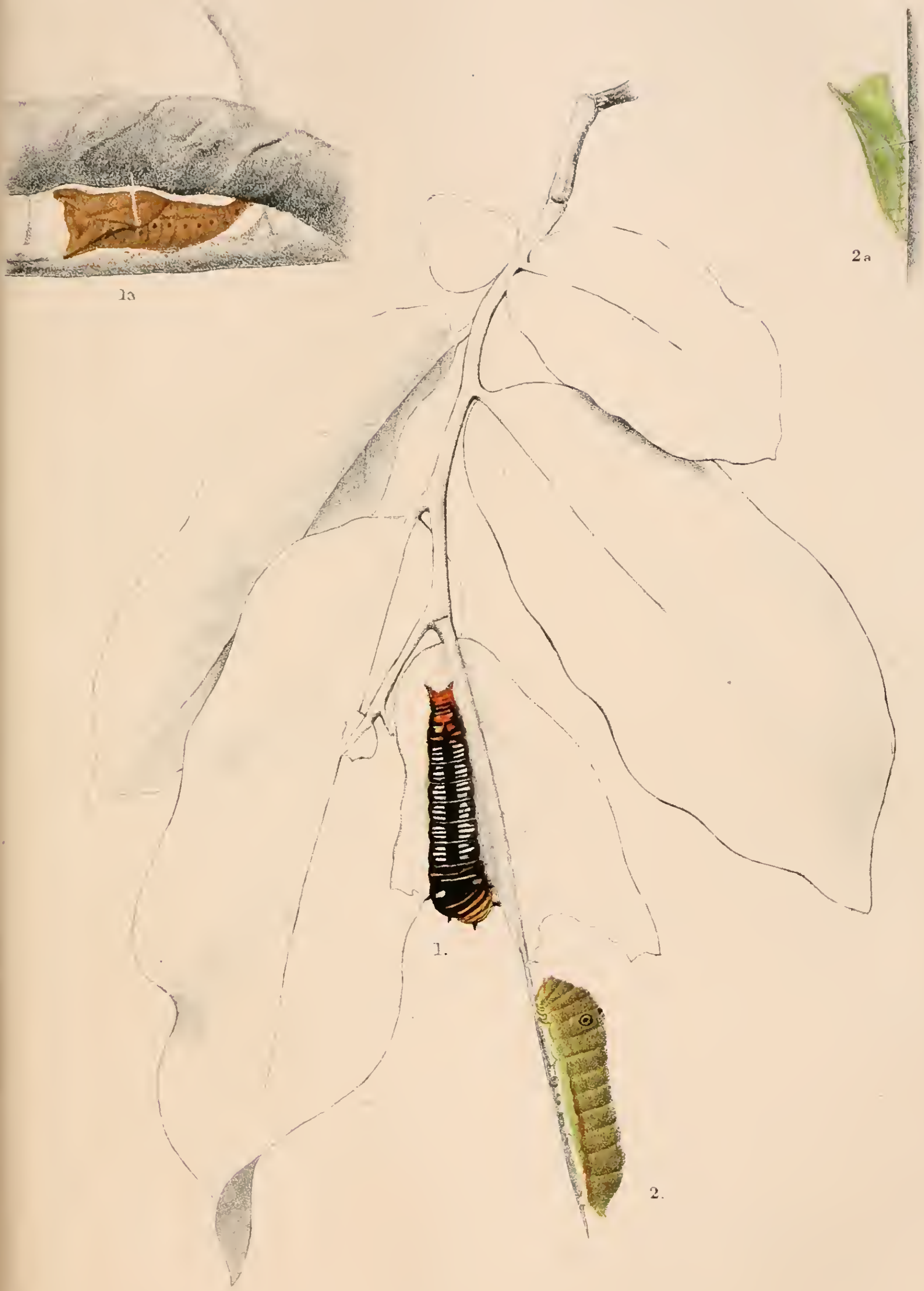
Larvæ somewhat thicker proportionally than those of *Mycalesis* and *Melanitis*. The head is larger, and is surmounted by a single, short, erect horn; the body is rough, thickest in the middle, suddenly attenuated from the 11th segment, and terminated by a long caudal horn. The colour is green, much paler on the under parts. The pupa is suspended by the tail, is of a uniform pale green colour, stout, smooth, and quite regular, except that the head-case, which is semi-detached from the thorax, is broad and angular, with two sharp points in front. We found a single specimen of this, feeding on dwarf bamboo, in the month of August. Descriptions from single specimens can never be put forward with confidence, and in this case we are not at all sure that the stunted appearance of the last three segments was not a mere deformity resulting from an accident.

42. *Athyma mahesa*, Moore.

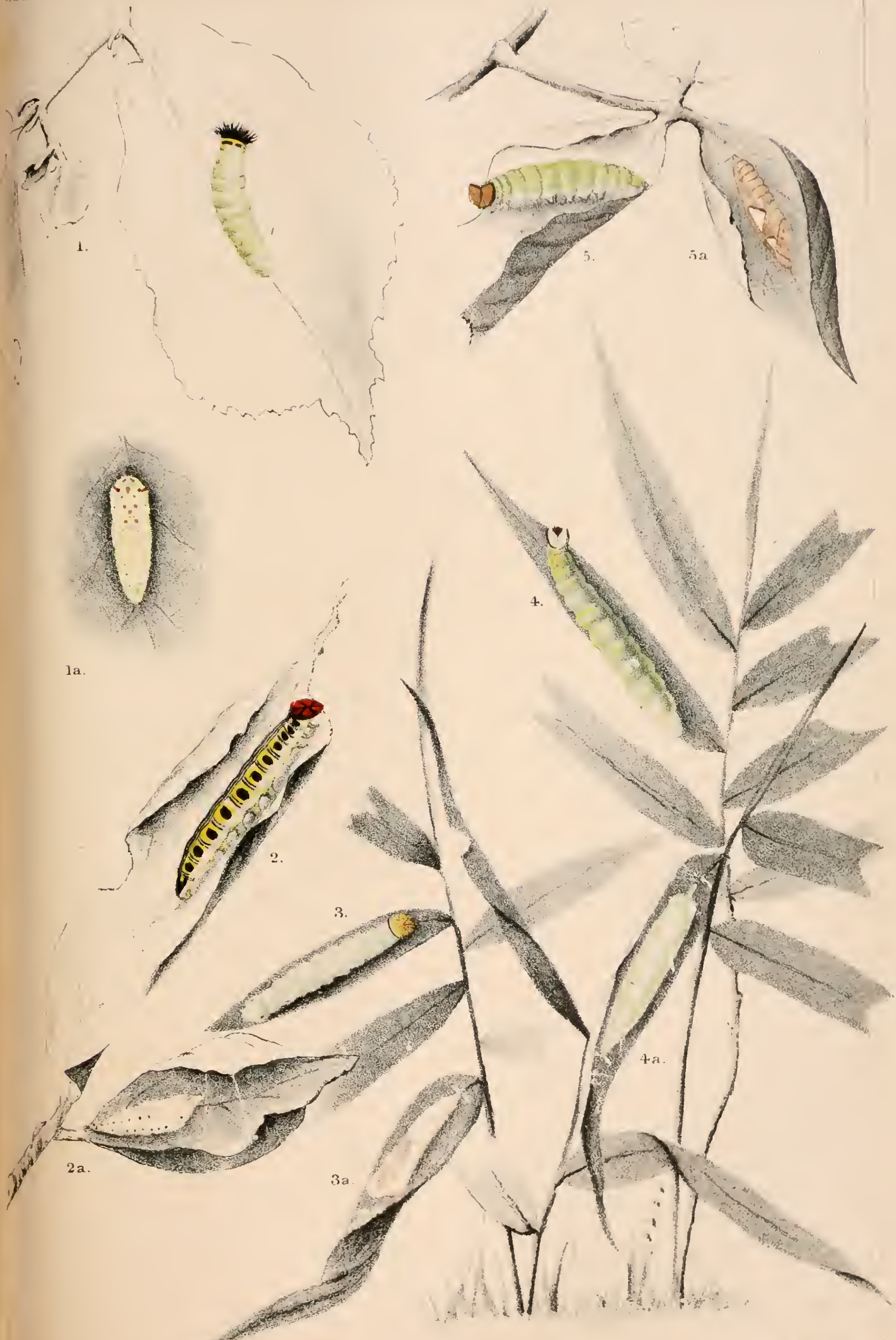
On the 26th of September a female of this species was noticed laying eggs on *Olea dioica*. Only one egg was secured, but by the most affectionate care this was successfully reared. In form the larva was exactly similar to that of *Limenitis procris*—already described :



West, Newman Chromo



West, Newman Chrom.


1.
1a.
2.
2a.
3.
3a.
4.
4a.
5.
5a

[illegible] Chromo

in colour it was green, with a whitish band round the 9th segment. Its habits were also very like those of *L. procris,* but not quite the same. It selected one of the side nerves of a leaf and ate away the soft parts on each side till the bare nerve stood out; then having barricaded the approach to this with fragments of leaf which it had contrived to cut off in feeding, mixed with excrement and silk, it rested motionless on the very point of the rib, unapproachable by ants or spiders. After the last moult it gave up these habits, and rested on the upper side of a leaf, where it was conspicuous enough. We infer that the worst enemies of this species are not birds, or parasites, but small spiders and predacious insects. The pupa is of the most brilliant silver colour, the segments and parts being outlined with brown. It is suspended perpendicularly, the abdominal segments slender, the thoracic region larger and expanded laterally; two long, sharp horns, issuing from the sides of the head, and at first parallel, diverge and point laterally; on the back there are two prominent processes, curved towards each other, and many smaller points, or tubercles.

43. *Neptis viraja,* Moore.

This was discovered by Mr. Bell feeding on a tree with pinnate leaves. From his description it appears to be like the larva of *N. jumbah,* without the spines, but we have not seen it ourselves and only notice it here because of the light which its strange habits throw on our discovery of the pupa of *N. hordonia* in a loose cocoon of dead leaves. The larva of *viraja,* Mr. Bell says, cuts through a leaf stalk in such a way that all the leaflets beyond the cut part hang over; then it cuts off each leaflet of the pendent part, joins it to the stem with silk, and lives in the house of dead leaves thus formed, *feeding on the dead leaves.*

44. *Cyrestis thyodamas,* Boisduval.

Mr. T. R. Bell noticed a female on the 10th of October depositing its eggs on the tenderest leaves and buds of a "banian" tree (*Ficus indica*), and secured six, of which two were reared. The eggs were curious and beautiful, high dome-shaped, or almost conical, with an aperture at the top fitted with a deeply dentate, flat cap, like a cogged wheel. The larva escaped by raising this and did not eat the shell. The larva was unlike any other that we have ever seen, slender, cylindrical and smooth; with two, long, curved, divergent filaments, or soft horns on the head, a single stouter sword-shaped one on the back at the 5th or 6th segment, curved backwards and serrated on its inner edge, and another on the last segment, curved forwards and serrated on its outer edge. The colour was a fine, reddish-brown, with a broad green band on the side from the 5th to the last segment. Pupa suspended by the tail, very much compressed, with a dorsal ridge from head to tail, high and obtusely pointed in the middle; the palpi-cases united and produced into a long, somewhat recurved, snout; colour brown, with fine dark striæ.

FAMILY LEMONIIDÆ.

Subfamily NEMEOBIINÆ.

45. *Abisara fraterna*, Moore.

We call this *fraterna* because we have been accustomed to call it by that name in other parts of the Bombay Presidency, "without prejudice" to *suffusa* or *prunosa*, or any other *alias*. The larva is flat, very broad in the middle, tapering to both ends, clothed sparsely with short hairs; head small, not enclosed in the second segment; colour light green. The pupa is also clothed with hairs, and altogether so like the larva that it is difficult to note exactly when the change takes place. It is closely attached to a leaf by the tail and a girdle. We found this very abundantly in July, 1889, and occasionally till the end of the rains, on *Embellia robusta*. This year it was scarce. The larva rests on the underside of the leaf, which is of the same tint of green as itself.

FAMILY LYCÆNIDÆ.

46. *Lampides ælianus*, Fabricius.

There is a full description of the larva and pupa in Marshall and de Nicéville, which we need not repeat. We may say, however, that all the larvæ we have seen were of a pure, pale, green colour, like young leaves of the tree on which they fed. This was the well-known "Karanj" (*Pongamia glabra*). In Karwar, in the month of March, we saw a female in winter dress laying her eggs on the leaf buds just opening. We did not attempt to rear from the egg, but allowed the larvæ to grow to a reasonable size and then took them, and got one butterfly of the summer form. The rest came to grief. There were a good many ants on the tree, which seemed to take the same interest in the larvæ as they take in *Aphides* of all sorts, and also on the sacchariferous glands at the bases of leaves, but we could not see that the larvæ were in any way helped by the ants, or dependent on them.

47. *Tarucus theophrastus*, Fabricius.

This also is carefully described by Mr. de Nicéville. We have reared it in Bombay on *Zizyphus jujuba*, the "Bore" or "Bear" tree.

48. *Tarucus plinius*, Fabricius.

We saw this species in Bombay laying its eggs on a leguminous plant with yellow flowers, which shoots up during the rains to the height of six or seven feet and dies immediately after, and which we, with such skill in botany as was at our command, identified as *Sesbania aculeata*. The leaves of this wretched plant wither ten minutes after you pluck them, but we succeeded in rearing one caterpillar by keeping it in a small, air-tight box. It is described in our notes as green, and of the usual wood-louse form, with a dorsal ridge of minute protuberances. The pupa was greenish, smooth, not a quarter of an inch long, and closely attached to the bottom of the box. The pupa state lasted seven days. Seven, ten, and fourteen days appear to be the commonest pupal periods.

49. *Castalius decidea*, Hewitson.

This feeds on the tender leaves of the "Chorna" (*Zizyphus rugosa*), and we reared a good many in September and October. The larva is pale green, and of the usual wood-louse form, with the head concealed under the second segment. The whole body is more or less pubescent, and there is a fringe of longer hairs on each side. The pupa is short and stout, constricted between the thorax and abdomen, clothed with short hair, closely attached by tail and band to any convenient surface; colour ochreous, mottled with brown.

50. *Iraota timoleon*, Stoll.

We got five or six of these in September, feeding on the bark of *Ficus glomerata*, and when that failed, on each other, for they are horrible cannibals. They never ate a leaf. The larva is very stout, but is much constricted in the middle, so that the circumference is greatest about the 3rd or 4th and 9th or 10th segments, varying a little with position. It moves as freely backwards as forwards, the whole ventral surface adhering closely to the branch, so that head and legs are seldom visible. The colour is clear green, with or without a brown bar on each side of the 10th segment. The pupa is thick and short, humped on the thorax, and somewhat constricted behind; light brown mottled with darker.

There were no ants with these larvæ when they were brought to us, but after they became pupæ they were discovered by a nest of common house ants, and were immediately put under a guard and carefully watched. But we shall have more to say on this subject under the next species.

51. *Arhopala centaurus*, Fabricius.

The larva of this species, which we found from June to October on *Terminalia paniculata*, one of the commonest jungle trees in Canara, has the usual wood-louse form, the head being concealed under the 2nd segment, and the sides extending beyond the legs, but it is proportionally longer and flatter than most of the family, and the last two segments are much depressed. There are a few strong, black bristles about each spiracle, and below these a fringe of similar bristles skirting the whole outline of the insect as seen from above. There is a honey gland on the 11th segment, but we saw no signs of erectile organs on the 12th. The colour varies a little, but is usually green below and on the sides, the whole back being of a fine, reddish-brown, very prettily marked with darker and lighter shades. The pupa is stout and broad, with the thorax humped, and the under-surface very flat. The last segment is peculiarly prolonged and expanded: to describe it appropriately a Greek word is required signifying,—having-the-form-of-a-horse's-hoof. By this alone the pupa is firmly attached to a strong web of silk in a loose, half-open, leaf-cell.

We never found either larva or pupa of this butterfly without an attendant guard of the ferocious red, or yellow, tree ant, *Œcophylla smaragdina*, as we believe the fiend is called. Half-a-dozen of them, kept with the larva in a bottle, lived quite happily for a week, and seemed to require no food besides what they obtained from it and from the leaves with which it was supplied. The larva was in no degree dependent on them, as we proved by rearing some from a very small size without ants. From this it would appear that the advantage which the larva derives from the alliance is protection against enemies. The house swarmed with a small brown ant, very active in killing and carrying off sickly larvæ, or butterflies just emerging from the pupa. We introduced some of these to a *centaurus*, and immediately they took it into their care and showed that they thoroughly understood the management of it. First the larva was assiduously caressed all over, especially about the head; then the ant went to the 11th segment, touched the gland gently with its antennæ, and was rewarded with a drop of honey, which it licked up at once. This process was repeated many times. Now, supposing these ants to be nine years old, like some of Sir John Lubbock's, it is not possible they ever could have seen a *centaurus* larva before, for the house in the walls of which they had their nest stood actually on the sand of the sea-beech, a mile from the nearest spot on which we ever saw this butterfly, or found its larva. How did they understand it so well? Perhaps they had had some practice with *Lampides ælianus*, the larvæ of which we sometimes found in the garden. Before leaving the subject we cannot forbear moralising on the fact that, when the larva has become a pupa and is no longer of any use to them, the ants guard it as carefully as before. How remote and contingent is any advantage they will derive from the preservation of the butterfly! Alas! it is not only the sluggard that has need to go to the ant and learn her ways and be wise.

52. *Zezius chrysomallus*, Hübner.

We found this on the same tree as the last, with the same unfailing body-guard of red ants. The larva is more elongated than the last, and the second segment, which is not depressed, but encases the head and projects beyond it, is anteriorly cleft into four points, like the teeth of a saw: the last two segments are depressed. There is a honey-gland, but apparently no erectile organs, a subdorsal and a lateral row of single short bristles, one to each segment, and below these, at the bases of the legs, tufts of strong bristles, those on the 2nd, 3rd and 4th segments springing from warty processes. The colour is green, with more or less of a reddish tinge on the back at the 3rd and 4th segments; but young larvæ show more brown than green, and there is doubtless a good deal of variation. The pupa is very like that of the last, perhaps not so flat on the under-surface.

From this species we learned a lesson on the importance of assuming nothing in Natural History without absolute proof. Early in the season of 1889 we made up our minds, from observation of *Arhopala amantes*, that its larva would be found on *Terminalia paniculata*, and when, after a little search, Lycænid larvæ were found, it never occurred to us to question what they were. They were *A. amantes* of course. As every specimen we got pined and died, we remained in this persuasion. Early in the following season fresh search was made, many larvæ were found, and though at first they died as before, we eventually succeeded in getting the butterfly, and lo! it was *centaurus*. This was a surprise, for though *centaurus* frequents the *Terminalia* trees as well as *amantes*, it is a very much less common species; but in the meantime we had found that there were two kinds of larvæ on the tree, and the one having proved to be *centaurus*, the other of course was *amantes*. But this other we could not rear: it defied us. We tried it with ants and we tried it without; we tried it in a bottle and we tried it in the open air. Sooner or later, it pined and died. At last we got one which was very nearly full grown, and though it soon sickened and seemed on the point of dying, it saved its life by becoming a pupa, and in due time forth came *Zezius chrysomallus!* The emergence of a *Terias hecabe* would scarcely have surprised us more. We still believe, however, that *A. amantes* feeds on *Terminalia paniculata*, and if we have another season in Canara, will storm the nests of the red ants. In the innermost *penetralia* of those we shall very likely find it.

53. *Virachola isocrates*, Fabricius.

Mr. de Nicéville's descriptions of this and the next species, and his accounts of their strange habits, are so full that we need not waste space on them in these notes. We reared this species in Poona many years ago, in the month of January or February, on the fruit of the pomegranate. It is rare in Canara, at least on the coast.

54. *Virachola perse*, Hewitson.

At Matheran and Mahableshwar we have bred this in March or April. In Canara larvæ may be found from August, or September, to April at least. We have never found it feeding on anything except the fruit of *Randia dumetorum*, called by natives "*Ghela*" (please pronounce *Ghale*), and never found more than one larva in a fruit. Mr. de Nicéville notices the very odd shape of this caterpillar's hinder end, but does not suggest its use. It is obviously a shovel for pushing refuse out of his chamber. Ants often frequent the fruits hollowed out by these larvæ, probably for the sweet juices of the fruit.

FAMILY PAPILIONIDÆ.

Subfamily PIERINÆ.

55. *Nepheronia pingasa*, Moore.

We found this butterfly laying its eggs on *Capparis heyneana*, at the very top of Goodhally hill, 1,850 feet high. We could not find the plant in any more accessible place, but the leaf is tough, and when kept in a well-corked bottle, does not wither for a week, so we had little difficulty in rearing the larvæ. The first was hatched on the 30th July and ate up the shell of the egg at once. It cast its skin on the 1st, 5th, 9th and 14th of August, and changed into the pupa state on the 22nd. This pupa met with an accident, but we found and reared a good many during August and September. The larva is long, cylindrical, or slightly depressed, and tapering perceptibly from the head, which is large, to the tail, which ends in two short, strong, spines clothed with bristles. The body is clothed with very minute hairs; colour green with a lateral row of conspicuous white spots from the 5th to the 12th segment, and rows of smaller spots on the back. The chrysalis, which is suspended by the tail and by a very long band, is a curious object, the thoracic portion being bent back almost at right angles to the abdominal, and the head being produced into a very long, sharp snout, while the wing-cases form a keel nearly half an inch in depth, and so thin as to be almost transparent. The colour is a uniform, pale, watery green. A peculiarity of this species is that the eggs are laid and the larva feeds from the beginning on the oldest and toughest leaves, like pieces of dark-green morocco leather.

56. *Delias eucharis*, Drury.

Larva long, cylindrical and smooth, with an oily gloss. Two subdorsal rows of long white bristles springing from minute white tubercles; head, sides and back sparsely clothed with short white bristles; colour brown, head and feet black. It may be found from the beginning of August everywhere, on the common "misletoe" (*Loranthus*), from which it will drop and hang by a thread if the tree is shaken. We have never found it feeding on anything else. Unlike most butterflies, this species lays as many as twenty or thirty eggs on one leaf, in parallel rows, with equal intervals, and the larvæ continue in some measure gregarious to the last, so that a large number of pupæ are often found, at little distance from each other, on a wall, or the trunk of a tree.

The pupa is closely attached by the tail and by a band, generally to a vertical surface, with the head upwards. It is moderately stout, with a short snout, two small tubercles on the head, a sharp but not prominent, dorsal ridge on the thorax, continued in a row of tubercles on the abdominal segments. Below these are two partial subdorsal rows; colour bright yellow; tubercles and a row of spots defining the wing-cases black.

Large numbers are destroyed by a dipterous parasite, very like a common house-fly.

57. *Appias libythea*, Fabricius.

We did not get this in Canara, but reared a good many in Bombay during April and May, on *Capparis horrida*. The larva is long, green, somewhat depressed, and has the rough surface and general aspect of a *Terias*, or a *Catopsilia*, but the anal extremity tapers a little, and is slightly but distinctly bifid. The pupa is of quite a different type from *Terias* or *Catopsilia*. It is closely attached to a leaf, and the wing-cases do not form a keel, but there is an acute dorsal prominence just behind the head, and a transverse dorsal ridge in the middle connecting two angular, lateral processes. The head ends in a short snout. The colour is variable, and probably depends on situation.

58. *Teracolus etrida*, Fabricius.

We reared this in Bombay in the month of December on *Cadaba indica*. From the very meagre note we made at the time, the larva appears to have been like that of *Terias hecabe*, but perceptibly enlarged near the posterior extremity. The pupa was also like that of *Terias*, but stouter, and the snout was long and sharply recurved. The colour was pale straw, or dirty white.

59. *Teracolus cypræa*, Fabricius.

This butterfly follows the curious distribution of its food plant, a bush, or small tree, known botanically as *Salvadora persica*, which grows on the *bahds* of salt-works in the Konkan, and is found at isolated places inland where there is salt in the soil. In the immediate vicinity of this tree the butterfly swarms: elsewhere it is rarely met with. We have reared it on the mainland, opposite Bombay, in November and December, and on the coast of Canara, at one place only, in May. The larva is very like that of *Terias*, cylindrical, or slightly depressed, with a rough surface, due to minute tubercles, from each of which grows a very small bristle. The colour is a uniform grass green, with a blue dorsal line, more or less distinct, and a yellowish lateral line dividing the colour of the back from the paler green of the under parts. The pupa is compressed, and has the wing-cases produced into a keel, like that of *Terias*. It is suspended in the same manner by the tail and a moderately long band. The colour is usually some shade of dingy, whitish-brown, or dirty green.

We have put this butterfly down as *T. cypræa* with much misgiving. One of the specimens which we reared in Bombay was so named for us by a friend who was an expert in the genus *Teracolus*, and we have not a doubt he was right as to that particular specimen at that time; but that all, or any, of those we have since reared would receive the same name at the British Museum to-day is more than we dare assume.

60. *Terias hecabe*, Linnæus.

As we have said, the larva and pupa of this are exceedingly like those of the last. The larva is long, green, rough, cylindrical, or slightly depressed, with a large head. The pupa is suspended by the tail and by a moderately long band; the abdominal segments are round, but the thorax is much compressed, the wing-cases uniting to form a deep, sharp keel. The head-case terminates in a short pointed snout. Ordinarily the pupa is solitary and green; but about the end of last September a boy brought us a dry twig, with fourteen pupæ on it so close together that they almost touched each other, and quite *black*. We are inclined to think that the withering of their food plant had caused these fourteen larvæ, which would ordinarily have suspended themselves singly among the leaves on which they were feeding, to migrate in a body in search of a place where they might safely pass the pupa state. Many *Pierinæ* and other larvæ seek each other's company at that time. Having selected a dead branch of some neighbouring bush, they acquired the colour of their surroundings, as nearly all *Pierinæ* and *Papilioninæ* pupæ do to a greater or less extent. A curious circumstance in this case was that all the butterflies which emerged from those fourteen pupæ had a large, rust-coloured patch on the underside of the apex of the forewing. *Terias hecabe* was very common at that time, but we met few with this mark well developed. The favourite food of this species is *Sesbania aculeata*, a monsoon annual, already mentioned as the food of *Tarucus plinius*. It also feeds readily on *Cassia tora*.

61. *Catopsilia pyranthe*, Linnæus.

Larva long, somewhat depressed, rough, green, with a white lateral line, and above it a black line, more or less conspicuous, formed by minute, flat, shining, black tubercles. In short, this larva is very like a big specimen of the last. The pupa is much stouter, and the keel formed by the wing-cases is much less pronounced. The normal colour is pale green, with a yellow lateral line. We have never found it on any plant except *Cassia occidentalis*. It habitually rests on the upperside, along the midrib, like almost all *Pierinæ* larvæ.

62. *Catopsilia crocale*, Cramer.

The larva is not easily distinguishable from that of the last; but in their choice of food the two species differ. We have found this on several species of *Cassia*, all arboreal, such as *fistula* and *sumatrana;* but never on the humble and ill-smelling *occidentalis*. The larva has sometimes a very broad, black, lateral stripe, sometimes wants it entirely. The pupa has the snout longer than it is in *pyranthe*. We have found this abundantly at the beginning and end of the rainy season, and also in April.

63. *Catopsilia catilla*, Cramer.

We have found this with the last, and cannot distinguish either larva or pupa.

Subfamily Papilioninæ.

It will save much repetition and facilitate description if we divide this subfamily into groups based on the form of the larva and pupa.

The Ornithoptera Group.

The three species of this group feed in this district on *Aristolochia indica*, a very common creeper, with bitter leaves, called by the natives *Sarpan-bel*, or *bali*, from the notion that it is a cure for snake-bites. It withers soon after the rains, except in very moist situations. The larvæ, like those of "protected" butterflies generally, are very easy to rear, eating freely in any situation and growing fast. They are much preyed on by small hymenopterous parasites, which emerge from the living larvæ and form white cocoons on their sides. We counted 67 from one *P. hector*. The larva dies soon after. There can be little doubt that the forked tentacle which all *Ornithoptera* and *Papilio* larvæ extrude from the neck when annoyed, is designed for defence against such parasites. It emits a reddish, possibly corrosive, fluid, with an offensive smell, and we have noticed one of these larvæ, when disturbed by ants, drive them off by swinging its head round with the tentacle extruded.

64. *Ornithoptera minos*, Cramer.

This butterfly almost disappears from the end of the year until the beginning of June, at least on the coast. The first rain brings a few out at the beginning of June, and larvæ are found in July, becoming increasingly common till October. The egg, which we have often found, is of a reddish colour, and under a strong lens looks very like a rough red orange. It is hatched on the eighth day. The larva is roughly cylindrical, tapering a little to each end, and carries two dorsal rows of fleshy processes, somewhat curved forwards, and a double row on each side of much shorter ones. The 2nd, 3rd and 4th segments have each an additional long pair between the dorsal and lateral rows. The head is smooth and black, the body of a uniform, dark, madder-brown, prettily lighted by a tinge of pink at the points of some of the fleshy processes. The dorsal processes on the 8th segment and a lateral pair on the seventh are pinkish-white, and a band of the same colour unites them. The pupa is suspended by the tail and a band, which encircles it much nearer the head than is usual with *Papilio* pupæ. In form it is stout, flattened and dilated in the middle, the head and thorax thrown back. The head is somewhat angular and tuberculated, and two of the abdominal segments carry each a prominent dorsal pair of pointed tubercles. In colour it is usually light brown, with a strongly contrasting saddle of "old gold," but we had one of a withered green hue with the saddle bright yellow. The pupa, when touched, makes a husky, squeaking noise, produced apparently by friction of the abdominal rings. The pupa state lasts nearly four weeks. This larva is a cannibal and, if not well supplied with fresh food, will devour pupæ of its own kind.

65. *Papilio hector*, Linnæus.

Larvæ were found throughout the monsoon, and once in April, on a plant near water, which had retained some green leaves. In June, when they first appeared, it was difficult to get food for them, as the young shoots of *Aristolochia* had scarcely begun to sprout. The egg must have been laid on the dry stalks of last season. The larva is so like that of *O. minos* that no detailed description is necessary, but, apart from the size, it may be readily distinguished by the absence of the pinkish diagonal bar, and by the fact that all the fleshy processes, which are shorter than in *O. minos*, are more or less pink, or red. The pupa has four pairs of *flattened* tubercles on the abdominal segments, and is altogether more angular than that of *O. minos*. In colour it is a light, pinkish-brown, mottled and streaked with a darker shade.

66. *Papilio aristolochiæ*, Fabricius.

We reared this in Canara during the rains, along with the last. In the Deccan, where it is much commoner, it feeds on *Aristolochia bracteata*, a feeble plant, with bluish-green leaves, that trails on black soil. The larva may be distinguished from both the last by a pinkish band encircling the body at the seventh segment, in which there is an insular patch of the ground-colour on each side. The ground-colour is richer than in *O. minos*, and the processes are all red. The pupa is scarcely to be distinguished from that of *P. hector*.

THE AGAMEMNON GROUP.

In these the form of the larva is well marked and easily recognisable. From the head, which is moderately large, the body increases in thickness rapidly to the fourth or fifth segment, and then tapers more gradually down to the tail. There are either three or four pairs of short sharp spines, one on the second and one on the 4th segment, sometimes a minute pair between these on the third, and a pair on the last segment. These spines are very prominent in the young larvæ, but decrease with each successive moult. There are no other irregularities, and the whole body is soft and very smooth. The pupa is smooth and regular, with the exception of a single frontal horn, or to be more correct, pointed process, rising from the thorax above the head. In habits these larvæ are very different from those of the last group. They are extremely shy and cautious, resting motionless most of the day on the upper side of a leaf, along the midrib, with their heads towards the stalk. The leaf on which they rest is usually carpeted with silk. They eat little and grow slowly, which appears to be generally a characteristic of the larvæ of those butterflies which have a stout thorax and strong flight.

They all seem to feed on trees with strongly aromatic leaves, belonging to the natural orders *Anonaceæ* and *Lauraceæ*.

67. *Papilio agamemnon*, Linnæus.

The form of the larva has already been described. It has four pairs of spines. The colour is at first smoky-black, but at the last moult becomes a light, clear, green, faintly marked with wavy lines of a darker shade. The pupa is normally of a pale watery-green, the horn being broadly tipped with rusty-brown, which continues in an irregular line along the outside edge of the wing-cases. The larva feeds on the Custard Apple (*Anona squamosa*), the "Ramphul" (*A. reticulata*), and others of the genus, and also on the "Ashok" (*Gualteria longifolia*). It is often difficult to find, and must be looked for on the less exposed leaves of trees in quiet, shady places. The season is from July till November : we do not recollect having found it at any other time.

68. *Papilio sarpedon,* Linnæus.

We found this at Karwar from July till October on *Litsæa sebisera* and *Alscodaphne semicarpifolia.* The larva is even more shy and retiring than that of *agamemnon,* and we got very few. It is very like that of *agamemnon,* but prettier, being of a soft, dark green, inclining to emerald and passing into a pale bluish on the last segment and the under parts. The pupa is easily distinguished from that of *agamemnon* by one mark, *viz.,* the horn is not straight, but curves slightly backwards.

69. *Papilio doson,* Felder, Plate E., *figs.* 2, 2*a*.

We found this at Karwar, in June and July, feeding on two trees of the order *Anonaceæ,* along with the larvæ of *P. nomius* and *agamemnon.* Some remained in the pupa state for nearly two months. At first sight the larva is very like that of *P. agamemnon,* but the second pair of spines is entirely wanting, and the third pair, which in *agamemnon* is rather long, curved and sharp, is reduced in this species to mere knobs, encircled with a black ring. The colour is generally black, or smoky, until the last moult, and then dull green, inclining to rusty brown on the sides; but some of our specimens remained quite black to the end. The distinguishing mark of the pupæ is again in the frontal horn, which is straight, as in *agamemnon,* but directed forward, instead of being almost erect. Its colour is normally green, but varies with that of the object to which it is attached. One, attached to white cloth, was almost pure white.

70. *Papilio nomius,* Esper, Plate E., *figs.* 1, 1*a*.

This butterfly was very common in 1889 in March, June and July. It frequented one particular spot about half way up the Goodhally hill: elsewhere we seldom met with it. On the 23rd of June we discovered the larva on a jungle tree belonging to the order *Anonaceæ,* but unhappily not identified, and literally collected hundreds. By the end of July these had all become pupæ, and we got no more. Of the pupæ a few produced butterflies in the course of the same month, but the great majority remained until February following, when a little rain fell and a few butterflies emerged, but they stuck to the pupa case, or else their wings failed to expand, for want of moisture apparently. We took the hint and watered about twenty, with the result that the butterflies came out of them all in good condition. We had lost a great many by accidents when on tour, and a few had hatched at odd intervals; but we kept what remained carefully until June, and within a few days after the bursting of the monsoon they all came out. From this it would appear that of each season's pupæ some are hatched at once, some are brought out by the spring showers or heavy dews of February and March, and the rest remain till June. Do the butterflies which come out in August and March lay eggs, and, if so, what becomes of them?

The larva of this species is not so thick proportionally at the fourth segment as those of the last three, and is somewhat quadrangular. It has four pairs of spines, which are small, but sharp. The most usual colour is that shown in the plate, *viz.*, black, banded on the sides with narrow white stripes, except on the first three or four segments and the last, on which there is more or less rusty red; but the shade varies very much, and in some the ground-colour is green. The pupa has the usual horn which characterises this group, and also two short process on the head, and is of some shade of earthy brown. It is attached by the tail and a close band in crevices, or under stones and roots. We furnished our cages with bits of broken tiles, but several of the larvæ preferred the old clay nest of a wasp, into the empty cells of which they crept. This curious habit is of course connected with the long hibernation which the majority of the pupæ undergo. Along with our P. *nomius* larvæ we found some of P. *agamemnon* and P. *doson*, and it is remarkable that, while very many of these had been attacked by a large parasitic fly, the grub of which ate its way out and fell to the ground after the pupa had formed, P. *nomius*, so much more conspicuous and feeding on the same tree, seemed to enjoy entire immunity from the pest.

THE ERITHONIUS GROUP.

In these also the larva is thickest at the fourth segment, but it wants the spines. On the second and last segment they are represented by blunt fleshy processes, while the fourth segment is surmounted by a rough transverse ridge.

In habits the larvæ are very similar to those of the last group, but they usually feed on the *Rutaceæ,* to which the orange and lime belong. The pupa is more or less crooked, the head and thorax being thrown back as in the *Ornithoptera* group, and two blunt processes project from the head.

71. *Papilio erithonius,* Cramer.

This is the commonest *Papilio* in the Presidency, and we have reared it abundantly in many places on different varieties of lime or orange trees, and also sometimes on the pomelo, but it forsakes all these for the unpleasantly odoriferous garden Rue. On the *bands* for salt works in the Konkan we once found it literally in flocks, feeding on a leguminuous plant with aromatic leaves. The form of the larva has already been described. The colour at first is a very dark shade of green, almost black, with two broad, diagonal, cross-bands of yellowish-white. At this stage the whole insect has an oily gloss, and has been supposed by some to mimic the excrement of birds. At the last moult it assumes a fine green colour, with certain yellowish-white markings, which, though they vary in extent, are characteristic of the whole group. These are the ridge on the forepart of the 4th segment, a line or band behind the 5th, an elongated triangular patch on each side, with its base on the light colour of the under parts at the 8th segment, and its apex sloping into the 9th, a similar, but smaller patch on the 10th, and nearly the whole of the last segment. The pupa is green when found among leaves, brown of various shades if attached to a trunk or dead branch.

72. *Papilio polytes,* Linnæus.

The larva of this is not easy to distinguish with certainty from that of the last, though of course it grows to a larger size. The pupa also is similar, but can be recognised at once, being proportionally much broader. This species also feeds on various species of orange and lime. We have never got it on rue.

73. *Papilio polymnestor,* Cramer.

We noticed this butterfly at Matheran, in the month of March, laying its eggs on a lime tree in the garden. In Karwar we reared a great many in September and October on a common wild orange

(*Atalantia* sp. ?). Another favourite food appeared to be *Garcinia xanthochymus.* In form, colour and markings the larva is very similar to that of the last two, but the enlargement of the 4th and 5th segments is much exaggerated, especially after the last moult. In the pupa the head-case and its two projecting points are more elongated.

74. *Papilio helenus*, Linnæus.

We got one larva of this on the "Tirphal" (*Zanthoxylum rhetsa* ?), a horribly thorny tree, leafless in the dry season, the berries of which are used by the natives in curry. The 4th and 5th segments were even more tumid than in *P. polymnestor*, forming a broad and high hump, nearly flat on the top, and bounded before and behind by rugged ridges of a whitish, or pale grey colour, chequered with fine brown lines. The anterior ridge ended in a large black and white ocellus on each side, and the whole aspect of the creature from the front had a strikingly grim likeness to the head of some beast or reptile, with heavy brow and angry eyes. In other respects no separate description of this larva is necessary. The pupa was distinguishable from that of *P. polymnestor* chiefly by the two projecting points on the head being somewhat curved upwards.

75. *Papilio liomedon*, Moore, Plate D, *figs.* 1, 2 and 3.

We do not know whether this deserves to be called more than a variety of *P. liomedon*, the larva and pupa of which have been figured by Horsfield. The figures are not good, but recognisable. This was perhaps of all our discoveries the one that pleased us most. It was the 2nd of August and we were on the very peak of Goodhally hill, when one of us noticed a *P. liomedon* flying suspiciously round a tree in very thick jungle. *P. liomedon* was a tempting butterfly, but with a painful effort of self-control the net was laid down and the butterfly patiently tracked until, after wearisome vacillation, it settled on a tender shoot of *Acronychia laurifolia.*

It remained settled for a long time, and then flew off altogether, leaving ten eggs, laid one on the top of the other, as shown in the plate. On the 7th of August the caterpillars emerged, and, to minimise risk, were divided between three glass tubes, tightly corked. On the 10th a gust of wind blew one of the tubes off the table and three of the caterpillars perished, but the remaining seven throve and were in due time transferred to a branch standing in a bottle of water. The mouth of the bottle was plugged with cotton wool, but two of them forced their way in and committed suicide. By a prompt use of the means recommended by the Humane Society for the restoration of persons apparently drowned, one was revived, but continued weakly, and was soon after killed by ants.

Five passed successfully through all dangers and became beautiful specimens, one female and four males. (This is one of the butterflies of which we rarely find females.) All through their lives these larvæ continued gregarious, dispersing occasionally to feed, but always returning to rest side by side on the upper surface of a leaf. The following dates may be interesting. Eggs laid, 2nd August; hatched, 7th August; skins cast (and eaten), 12th August; again, 17th August; again, 20th to 22nd August. The most advanced cast its skin again on the 28th of August, became a pupa on the 2nd of September, and emerged on the 15th of September. The others followed within two days. At first the larvæ were of an oily yellow colour, and bore many pairs of spiny points, but these disappeared with age, and after the last moult there were only the short fleshy processes on the 2nd and last segment which characterise the group, and one additional curved pair on the ninth segment.

The colour after the last moult was a clear slaty blue, changing eventually to a greenish tint, with light brown markings very much the same as those which characterise the rest of the group. The pupa was more abruptly bent back from the middle of the thorax than that of *P. erithonius*, and adorned on the thorax with a sword-shaped horn, fully ⅜ of an inch long, and always bent a little either to the right or left. The colour was brown, or green and yellow, according to situation.

THE DISSIMILIS GROUP.

76. *Papilio dissimilis*, or *panope*, Linnæus.

These, or rather, this species (for there is no question now of their identity) constitutes a group by itself. The larva is not unlike those of the *Orinthoptera* group in form, having similar rows of fleshy processes; but it is by far the handsomest *Papilio* larva we know, being of a dark brown colour, with a bright red spot at the base of each process, a dorsal row of large, irregular, yellow patches, and a partial lateral row ending in a diagonal band which connects the two. The pupa is unique, exhibiting one of the most remarkable instances of protective resemblance we know. It exactly resembles a dead twig about an inch long and less than a quarter of an inch in diameter, broken off irregularly at one end. The last segment is so modified that the pupa is not attached by one point, but appears as if it had grown out of the branch to which it affixes itself. We found this in Bombay on *Tetranthera apetala*, and in Karwar on *Alseodaphne semicarpifolia*, at the beginning of the rains and again in September and October. We got both sexes of each form. Some of our pupæ continued in that state for a month or two.

Family HESPERIIDÆ.

The caterpillars of this family are generally easy to recognise. The head is large, the body smooth, long and thickest in the middle and usually green in colour. The majority feed on grasses, and the habit of folding, or rolling up, a leaf to form a cell is very general. They are more likely to be mistaken for the larvæ of moths than for those of any other family of butterflies, but the observant collector will notice that while those moth larvæ which form cells generally foul them, the *Hesperiidæ* are cleanly in their habits.

77. *Gangara thyrsis*, Fabricius.

Larva cylindrical, but much attenuated towards the head, which is larger than the neck and slightly conical, with the apex upwards. The whole insect is covered with a white fluffy secretion, which forms long filaments and comes off on everything which touches it. The colour of the skin, where it shows itself at all, appears to be light green, or in parts bright red. We got this in June, and again in September and October, on the cocoanut and betelnut palms.

The larva lives securely in a strong cell, formed either by firmly joining the edges of a leaf together, or else by rolling it spirally. When about to turn into a pupa it closes the end of the cell towards which its head is pointed. The pupa is smooth, with the abdominal part proportionally very long, the thoracic part short and stouter, and the wing-cases produced into long curled filaments. The last segment of the abdomen is broad and flat, and from the centre of it there springs a horny tail like the telson of a shrimp. By this the pupa is attached to a strong cord of silk stretched across the cell. Otherwise it is quite free, having no encircling band. This arrangement enables it to vibrate with extraordinary energy when its cell is touched, making a sound like a rattle.

This and some other larvæ of *Hesperiidæ* have very formidable jaws.

78. *Suastus gremius*, Fabricius.

We got this in June and October, also on the cocoanut palm. The larva, like the last, forms a tube-cell by joining the edges of a leaf, and never leaves it. The pupa is formed in the same shelter, which is first lined with silk and closed at the ends. The larva is elongated, smooth, thickest in the middle, the last segment flattened, the head moderately large, oval, obliquely attached ; colour pale green, with a thin, dark blue, dorsal line ; head light green, or whitish, with a horse-shoe mark of dark brown. The pupa is like a moth pupa of the most normal type and of a dirty yellowish colour. The head is moderately broad without a snout. The wing-cases are produced into a short double filament.

79. *Parnara bevani*, Moore.

Larva smooth (it is really clothed with short bristles almost invisible to the naked eye), thickest in the middle, pale green ; head large, slightly bilobed, dark brown, or pale brown variously marked with darker. Pupa like that of *S. gremius*, but of course much smaller. We found this in Canara in June, August and September on rice, and have often reared it in Bombay on grass. It forms a tube cell which it never leaves, feeding on the edges of it. When about to become a pupa it lines the cell with white silk, to which the pupa is attached by the tail only. In every respect both larva and pupa show much more likeness to *S. gremius* than to *P. kumara*.

80. *Parnara kumara*, Moore, Plate F, *figs*. 4, 4*a*.

Larva elongated, thickest in the middle, tapering to the head, smooth, dull green, obsoletely banded with darker green, and showing a dorsal line of the same colour ; head large, bilobed, white, edged with chocolate and divided by a chocolate line. Pupa pale green, slender and smooth, with a sharp frontal process or snout. We got this in September on rice. It forms no cell, and the pupa is attached to an open leaf by the tail and a band.

In the figure this larva is represented on a bamboo leaf by mistake.

81. *Chapra mathias,* Fabricius.

Larva smooth, thickest in the middle, pale green; head large, somewhat triangular, and of a greenish-white colour, with a narrow red border line on each side. Pupa very like that of the last species. This also feeds on rice, forming no cell. We got it in June, August, and September.

82. *Chapra prominens,* Moore.

We got a single specimen of the larva of this on what seemed to be a leaf of some species of Arum. It became a pupa the same day. The larva was very like that of *Udaspes folus,* described further on, but the head was whitish, the lobes bordered and separated by a brown line, with a brown spot in the centre of each. The colour of the body was pale green, with two light stripes on the back. The pupa was exactly like that of *U. folus,* and similarly attached, colour pale green, with two dorsal white lines.

83. *Baracus septentrionum,* Wood-Mason and de Nicéville.

Mr. T. R. Bell found a single specimen of this larva in August on grass. We found that it would eat two or three species of grasses. We noticed nothing by which this could be distinguished from the larva of *Parnara bevani,* except that the head was black. It lived after the same manner in a tube. The pupa was regular, slender, with the head broad and, like *P. bevani,* had neither a snout nor any prolongation of the wing-cases. It was attached by the tail only. The colour was semi-transparent, impure white, with two black dots behind the head.

84. *Udaspes folus,* Cramer.

Larva smooth, long and much attenuated towards the head, which is large and well bilobed; colour pale green, with a bluish tint on the back; head dark brown. Pupa greenish-white, slender, with a sharp snout; wing-cases produced into a long, straight, double filament. It is attached by the tail and a silken band to a leaf, which is partially drawn over it. We found this from July to October, feeding on the wild turmeric.

85. *Matapa aria*, Moore, Plate F., *figs*. 3, *3a*.

Larva smooth, tapering somewhat towards the head, but tumid and flattened at the anal end, greenish- or bluish-white, with a linear black collar, and a lateral row of minute black spots, those on the tumid penultimate segment larger than the rest; head light brown, large, and slightly bilobed. Pupa of a dirty whitish colour, the abdominal part much lengthened and slender, the thorax thicker and very short, constricted just behind the head, no snout, wing-cases produced into a short united filament. We got this in October, feeding on a dwarf species of bamboo. It forms a cell by rolling the leaf spirally. The pupa is attached by the tail only, and rattles in its cell like that of *Gangara thyrsis*.

86. *Telicota bambusæ*, Moore.

Larva smooth, thickest in the middle; head moderately large and slightly bilobed; last segment depressed; colour greenish, albescent on the last segment. Pupa brown, more compact than in the last species, abdomen short, constricted behind the head, wing-cases not produced. We got this in October on the same leaf as the last, with a third species which we unfortunately lost. It forms a cell by joining the edges of a leaf.

87. *Parata chromus*, Cramer.

Larva stouter than most of the family, sparsely clothed with short hair, the head a little larger than the neck and scarcely bilobed; colour variable, most commonly pale yellow, with a dorsal line and two subdorsal rows of large, brown or purplish spots, the space between being clouded with the same; the sides and under parts light green. Pupa quite regular, stout, pale green, covered with a chalky white powder. This caterpillar, which may very easily be mistaken for that of a moth, was found on the "Karanj" tree (*Pongamia glabra*), which it almost denuded, in June and July. It appeared again, not in such numbers, towards the end of the rains.

It forms a close cell, usually by joining two leaves at the edges. The pupa is formed in this.

88. *Bibasis sena,* Moore, Plate F., *figs.* 2, 2*a.*

This resembles the last, but is proportionally longer. The head is very large and rounded, and of a bright red colour, chequered with black. The centre of the back is blue, with three black, longitudinal lines; the sides are yellow, with transverse blue and black markings. The pupa is regular and moderately stout, of a bluish-white colour, with four rows of small black spots on the abdominal segments, and a black diamond on the middle of the back. We got several of these in September, but could not identify the food-plant, or procure any more of it. Consequently they all perished but one, and it became a very stunted pupa. The figure and description were taken like a "dying deposition," and are not so satisfactory as we could have wished.

89. *Badamia exclamationis,* Fabricius.

At the beginning of the rains of 1889 we found great numbers of these on several different trees, but we had not begun to make these notes at that time and kept no description, and this year we have not found one. All we can say from memory is that the larva bore a general resemblance to those of the last two, being variegated in colour and variable. The pupa was stout and regular, not unlike that of *P. chromus,* but attached itself to the sides and top of the cage.

90. *Tapena thwaitesi,* Moore.

We found a single specimen of this in August on *Doris scandens,* of the small leaves of which it made a rough cell for itself. It became a pupa before we could write a description of it, so we can only say that it was of a uniform, creamy-white colour, the head being large and white also, with a brown border line. The pupa was slender, but regular, with head-case pointed.

91. *Tagiades atticus,* Fabricius, Plate F, *figs.* 5, 5*a.*

Larva smooth, slightly depressed, thickest a little in front of the middle, neck slender, head large, bilobed, lobes diverging and pointed at the top ; colour more or less dark, bluish-green, darkest on the back, collar white, head chestnut, mandibles large and black. Pupa attached by the tail and by a band, regular, with short snout, or palpi-case, colour semi-transparent green, or light pinkish-brown, with darker lines defining the segments, and two conspicuous, triangular patches of porcelain-white on each side. We found this occasionally from the end of June till October feeding on several species of *Dioscorea*. The habits of the larva are curious. It cuts out an oval piece of a leaf with the margin deeply toothed, or scolloped ; this is left attached by a narrow neck, including one of the principal veins of the leaf, and bent over so as to form a cell with open archways all round. In this the larva lives and rushes at intruders with its black jaws extended. It becomes a pupa in the cell.

92. *Tagiades obscurus,* Mabille.

We found the larva of this on the same leaf as the last, and did not notice that it was different, having our hands at the time very full. The pupa was similar in form to that of *T. atticus*, but of an impure, pinkish-white colour, sparsely dotted with black on the thorax and wing-cases.

93. *Celænorrhinus fuscum,* Hampson.

Larva of the *Tagiades* type, smooth, somewhat flattened, thickest in the middle, dull green, darkest on the back, with two longitudinal pale lines ; last segment paler ; head large, bilobed, reddish-brown. Young larvæ are dark brown, and some retain this colour to the end. The pupa is also like that of *Tagiades*, attached by the tail and by a band, stout, with thorax slightly humped, very small snout, and wing-cases produced into a long double filament; colour semi-transparent green. We found this abundantly in September and October, on "Karwee" (*Strobilanthus*). It lives on the upper side of a leaf, cutting off and turning over a portion to serve as a roof. It is fierce and repels intrusion. Like many *Hesperiidæ*, it grows very slowly.

94. *Abaratha ransonetti,* Felder, Plate F, *figs.* 1, 1*a*.

Thickest about the middle, somewhat pointed at the anal end, transversely rugose and clothed with very short hair ; head thickly set with curved bristles ; colour pale green, with a yellow collar and a black demi-collar behind it; head black, bristles white and black. Pupa attached by tail and band, moderately stout, with short snout and several pairs of small tubercles on the head and thorax; colour pale greenish-white, tubercles black or red. This was found in June and again in September and October on "Kiunee" (*Helicteres isora*). It sometimes forms a loose cell by bending the leaf over.

LIST OF FERNS GATHERED IN NORTH KANARA
BY MAJOR T. R. M. MACPHERSON.

Genus and Species.	Remarks.
1. Gleichenia linearis (Burm.)	
2. Cyathea spinulosa (Wall.)	A tall tree fern, growing to 10 or 12 ft. high in suitable localities; found only above ghâts.
3. Alsophila glabra (Hook.)	A tree fern, never growing to any great height. Found chiefly above ghâts, but also occasionally below ghâts at no elevation.
4. Trichomanes kurzii (Bedd.)	At Godhali and on the Anshi Ghâut.
5. ,, intramarginale (Hook and Grev.)	Found at Devimanni.
6. Microlepia speluncæ (Linn.)	
7. Stenoloma chinensis (Swartz.)	
8. Schizoloma lobata (Poir.)	Rare; only found at Jog.
9. ,, ensifolia (Swartz.)	
10. ,, heterophylla (Dry.)	In Kanara the fronds are frequently tripinnatifid, and I have gathered fronds at Sirsi, which were tripinnate as in *Lindsaya heterophylla*, but with the veins anastomosing.
11. Adiantum lunulatum (Burm.)	
12. ,, æthiopicum (Linn.)	Rare; found only near Supa.
13. Cheilanthes tenuifolia (Swartz.)	
14. ,, farinosa (Kaulf.)	
15. Pteris longifolia (Linn.)	
16. ,, pellucida (Prest.)	A variety on the Anshi Ghât has broad white bands down the centre of the pinnæ.
17. ,, quadriaurita (Retz.)	
18. ,, ,, *var.* Setigera.	
19. ,, aequilina (Linn.)	
20. Campteria biaurita (Linn.)	
21. Ceratopteris thalictroides (Linn.)	
22. Blechnum orientale (Linn.)	

LIST OF FERNS GATHERED IN NORTH KANARA—(*contd.*)

Genus and Species.	Remarks.
23. Thamnopteris nidus, *var.* phyllitidis (Don.)	Fronds frequently 3 inches broad and over 2 ft. in length.
24. Asplenium lunulatum (Swartz.)	Found at Nilkund.
25. ,, falcatum (Lam.) ..	Found at Yekambi.
26. ,, unilaterale, *var.* Rivale (Bedd.)	Found at Nilkund, Yan and Malimani.
27. ,, ,, *var.* Udum (Atkinson.)	Found at Anmode and Cooesi.
28. ,, laciniatum (Don.)	Found at Anshi and Yekambi.
29. Athyrium hohenackerianum (Kye.)	
30. ,, macrocarpum (Blume.)	
31. Diplazium asperum (Blume.)	
32. ,, latifolium (Don.)	
33. Anisogonium esculentum (Prest.)	
34. Aspidium subtriphyllum (Hook.)	Found at Malimani.
35. ,, polymorphum (Wall.)	
36. ,, cicutarium (Swartz.)	
37. ,, multicaudatum (Wall.)	Found on the Nilkund Ghât.
38. Pleocnemia membranifolia (Prest.)	
39. Lastrea calcarata, *var.* ciliata (Wall.)	
40. ,, syrmatica (Willd.)....	Found at Anmode.
41. ,, filix-mas, *var.* cochleata (Don.)	
42. ,, dissecta (Forst.)......	Found at Bilgi and near Menshi.
43. ,, tenericaulis (Wallich.)	Indusium always present in young stage of the plant in Kanara.
44. Nephrodium unitum (Linn.)	
45. ,, pteroides (Retz.)	
46. ,, extensum (Blume.)	Found near Sirsi and Manchikeri.
47. ,, Pennigerum (Blume.)	
48. ,, molle (Desv.)	
49. ,, crinipes (Hook).	Found at Jog and Katgal.
50. ,, truncatum (Prest.)	
51. Nephrolepis cordifolia (Linn.)	
52. ,, exaltata (Linn.)..	Fronds sometimes 6 ft. long.
53. ,, acuta (Prest.)....	Found near Supa.
54. ,, ramosa (Beauv.)..	Found at Karwar and on the Anshi Ghât, growing on trees.
55. Goniopteris prolifera (Roxb.)	
56. Niphobolus adnascens (Swartz.)	
57. Drynaria quercifolia (Linn.)	

LIST OF FERNS GATHERED IN NORTH KANARA—(*Contd*).

Genus and Species.	Remarks.
58. Pleopeltis linearis (Thumb.)	
59. ,, lanceolata (Linn.)..	Found at Yan.
60. ,, membranacea (Don.)	
61. ,, punctata (Linn.) ..	Found at Tyagli and Kansur.
62. Vittaria elongata (Swartz.) ..	Found near the coast at no elevation, and also above ghâts.
63. Stenochlœna palustre (Linn.)	
64. Polybotrya appendiculata, *var.* aspleniifolia (Bory.)	
65. Gymnopteris variabilis (Hook.)	
66. ,, ,, *var.* axillaris (Cav.)	
67. ,, contaminans (Wall.)	
68. ,, subcrenata (Hook.)	
69. ,, presliana (Hook.)..	Common everywhere in river beds.
70. Acrostichum aureum (Linn.)...	Found on the banks of salt-water creeks.
71. Osmunda regalis (Linn.)......	Common both above and below ghâts.
72. Lygodium microphyllum (Roxb.)	
73. ,, flexuosum (Swartz.)	
74. Angiopteris evecta (Hoffm.) ..	
75. Ophioglossum nudicaule (Linn.)	

THE PHYSICAL GEOGRAPHY OF THE NEIGHBOURHOOD OF BOMBAY.

By W. F. Sinclair, C.S.

(*Read at the Society's Meeting on 23rd September 1890.*)

The perusal of Mr. Hart's interesting paper on "Prehistoric Bombay," suggests the following remarks:—

If any one will take the latest and best chart of Bombay harbour, he will find that the meridian of the Observatory—one of the highest places on Kolaba Point—is that (within a few yards) of the Flagstaff on Kamballa Hill, the highest point on Bombay Island Proper, and very nearly that of Worlee Point, and so on to Dharavi, in the north of the Salsette Islands, whence are said to have been brought the perfect basaltic columns that were used throughout this region by the wealthier builders of the 15th and 16th centuries.

I have not been at Dharavi itself, so I cannot speak of the quarry. But the stones can be seen any day at Kalyan on the G. I. P., especially in the revetment of what is called the Shenalla tank, supposed to have been built in 1505. Here they are used as bonds, and are quite as perfect in shape as any at the Giant's Causeway, or on the Rhine, though not of any great size.

Between the Observatory and Kamballa Hill, this same meridian passes through the northernmost point of what was once "Old Woman's Island," now a part of Kolaba. Continue it to the southward from the Observatory and it leads you close to the southernmost point of the Prongs, across the harbour's mouth to the outer edge of the Thall Reefs, and right through the middle of Kennery Island, where are some of the finest masses of basalt in the Lower Konkan.

From this on southward the meridian lies near the outer edge of the "Kennery Flats" and Alibag Reefs, preserving for a distance of about 14 statute miles (N. and S. of Kennery) an almost uniform depth of 17 feet of water.

Due west of Alibag the edge of this basaltic sea-floor bends to the south, south-east, through the Chaul Kadu Beacon, which may be said to mark the southern end of the great Bombay sea-wall.

Malabar Hill, standing well to the west of the Observatory, marks a projecting point or bastion of the main rampart, which throughout its length points to the poles a good deal more accurately than the needle can be always trusted to do.

Lay aside the chart, take a map, and you will find that the hills of Salsette and Trombay Islands and the Kankeshwar and Parsik hills on the main land, are similarly "polarized." But when you come to the next range eastward, that of Matheran, this arrangement is only visible in single hills, and not in the outline of the whole group; and the same is the case with the Sagargarh and Funnel Hill Ranges and those of Manikgarh and Mira Dongar in Pen.

East of these, again, comes in one of the most curious features of the region. We commonly talk of these ranges as "spurs of the ghâts," and so perhaps they originally were. But now the "great break off," so graphically described by Mr. Hart, has separated them from the central mass of the Deccan trap; and every one of them between Mahuli and the Raigarh group is divided from the ghâts proper by a deep gap.

From the hot springs of the Tansa, behind Tungar, behind Matheran, behind Mira Dongar and Sagargarh, a man could drive a bullock cart to the hot springs of the Savitri at So (near Mahad), passing those of the Amba, at Unhere, on the way. He would not have to cross any pass 500 feet high. If he was ambitious enough to take a still more eastern line behind Surgarh, he would probably leave the wreck of his cart on the road; but he would not require to climb 600 feet at any point.

It is an unfortunate peculiarity of our topographical surveyors that, although they give us the exact height of all the important peaks, and of a great many very unimportant ones, they seem never to think the height of a pass worth measuring. Most of those, whose height is given in their maps, have been measured by the District Engineers, and even the information obtainable from them has not always been utilized. Where they have not been, we are left to mere conjecture, or to resurvey. I have not myself found time to pass through the gap between the Surgarh hills and the main wall of the ghats; but from the outside it appears to be quite as deep as the Umbre pass between the Pen hills and the Khandála ghats, which is a natural cart-road leading from the Amba Valley to Campoolee.

The next great gap to the southward is that between the Raigarh group of true spurs and the Janjira plateau, and it has a tidal creek through the middle of it. All these ranges and passes lie more or less north and south, and so naturally do the river courses and valleys. And every here and there, throughout the region wherever the basalt is exposed, you come on queer long straight cracks in the rocky mass, still lying in the same direction inland; these are naturally appropriated by the drainage water, which has in the course of ages modified them considerably. On the coast they form channels through the reefs, and landing places, where these would, if entire, forbid all landing.

As far as I am aware the whole system is confined to a very limited area, of which Bombay Harbour is nearly the centre, and the corners may be placed roughly at the Malsej and Fitzgerald ghâts, and the mouths of the Savitri and Waitarna. Future survey, or correspondence from gentlemen who know more than I of the neighbouring districts, may perhaps extend these limits; but, as far as I can find out at present, they are pretty nearly those of the great break-off.

The main external interest of the whole subject is that the existence of modern Bombay is due to this forgotten subsidence of the basalt floor of the land. Without it, indeed, there would doubtless have been ports here, as there were in different ages on other parts of the coast. But for the growth of modern Bombay were wanted an islet and a harbour, where the infant settlement and its weak fleets were secured from Mogul and Maratha armies, and where the great ships of modern commerce can get shelter in deep water at all seasons.

The subsidence that buried Mr. Ormiston's *Khair* forest under what is now the Prince's Dock has resulted, in due course of time, in the growth of its wood of masts and other objects less picturesque.

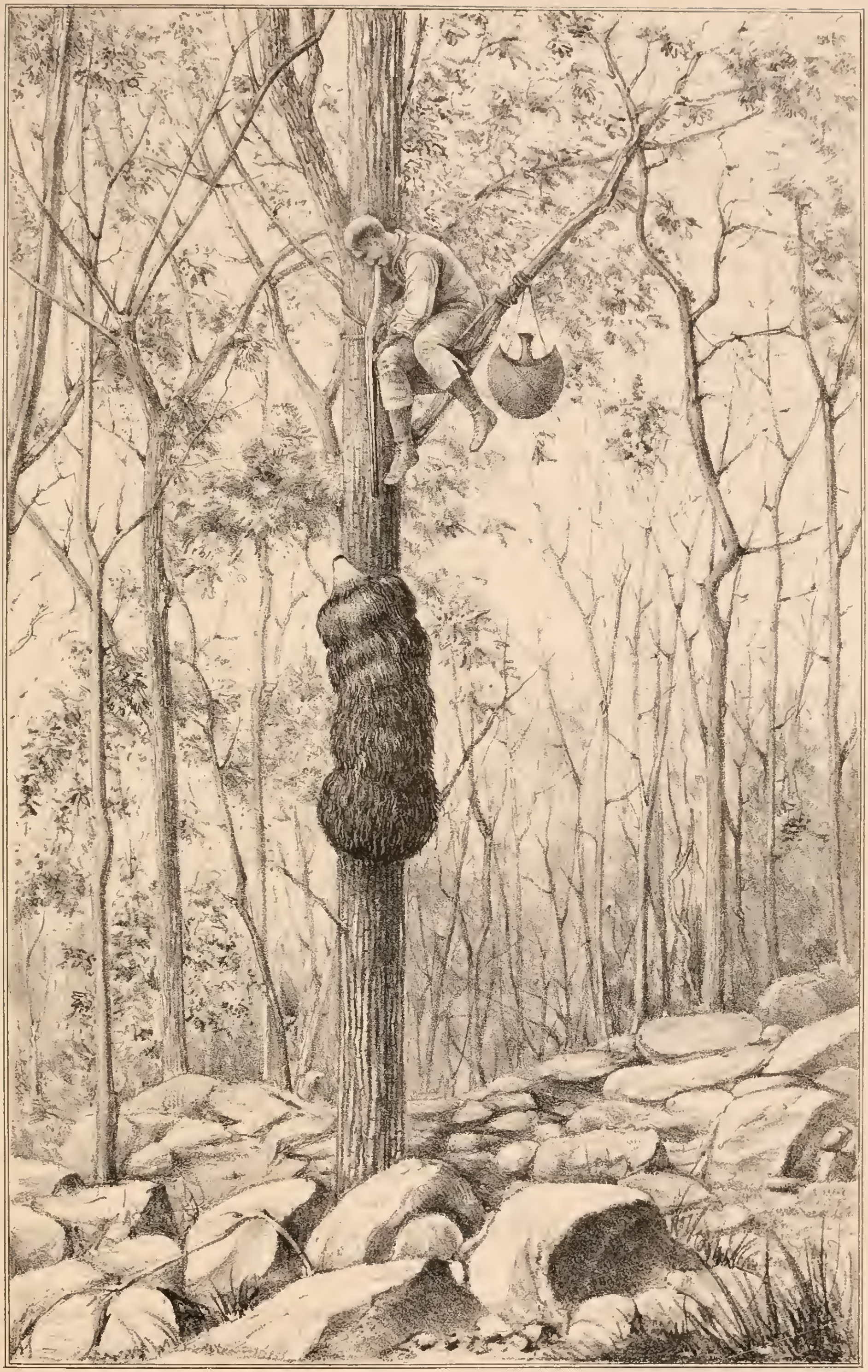
I have only to remark, in conclusion, that I do not think it safe to assume that this event was witnessed by any human being. The fact that burnt logs were found in the buried forest is not in itself conclusive. A forest fire might be started by volcanic agency, or by lightning, or, even it is said, by the rubbing together of dead bamboos in the wind.

Now *Khair* forests are things well known to us to-day, and we know that a fire will pass through them, consuming the dry grass and scanty fallen leaves, and igniting dry fallen trees, without seriously injuring those still "a-growing and a-blowing." Such fallen trees once alight will continue to smoulder, until the fire is extinguished by a shower, or even by a heavy dew.

WOUNDED BEAR CHARGING UP A TREE.

By J. D. Inverarity.

It is well known that bears are good climbers, and that they are in the habit of ascending trees after bees' nests and jungle fruits.



From a photograph taken by Mr J. D. Inverarity

Mintern Bros. lith. London

WOUNDED BEAR CHARGING UP A TREE.

That they charge readily enough if encountered on foot is familiar to all sportsmen. The incident I am about to relate of a bear charging up a tree at its adversary is, I think, uncommon, although I remember on a previous occasion seeing a wounded bear charge to the foot of the tree from which it was fired at, and rear itself up against a ladder on the top rung of which was seated Colonel Bowie, now Inspector-General of Police, Central Provinces.

On May 17th, 1890, I was beating a rocky hill in the Central Provinces, and was posted in a Saj tree (the Black Eque), when a she-bear galloped by at a few yards' distance. I shot her, and she rolled about on the ground after the manner of bears, complaining bitterly. I fired the second barrel at her as she lay on her back, which appeared to act like a tonic, as she jumped up, charged straight at the tree, and at once began to climb it. So quickly did she come, that, although I never reloaded quicker in my life, she reached my legs just as I got one barrel reloaded. She was on the point of seizing my leg with her teeth when I fired and dropped her. My hat fell off in the scrimmage, and on reaching the ground she tore the inside out. She then made off at a slow walk; I reloaded and hit her with both barrels, knocking her down once, and, though all the shots but one she had received were well forward, she was still able to walk, and was finished by a shot from my companion, Captain Burton, Royal Fusiliers, who was posted about 100 yards from me. This was a case which one occasionally meets with in sporting prints, appropriately headed "Extraordinary Tenacity of Life in a Bear." The shot in the tree I found had hit her inside the head of the humerus, breaking the scapula, and so close was she that the hair on her face and chest was singed with the flash, and the wads were driven into the wound: I found them resting against the head of the humerus, The express bullet had split up on the scapula and only a small fragment had entered the cavity of the chest. My mala was tied on the lowest branch of the tree, and I was sitting 13 feet from the ground. The stem of the tree was 3 feet 6 inches in circumference, two feet from the ground, or about 14 inches in diameter. The bole of the tree was perpendicular with only one small shoot at a distance of 5 feet from the ground. My legs hung down alongside the tree, so that my feet were at a height of 11 feet 6 inches. The highest claw marks of the bear were 11 feet 6 inches high, alongside my right foot. The above details are given from actual measurement.

In order to carry away with me an accurate record of the incident, I tied the defunct bear to the tree, and with the able assistance of Captain Burton took a photograph, with the result depicted opposite. Although, of course, the bear was dead, the picture gives a correct representation of the tree. The bear, however, is too low, as her highest claw marks were at the point my right foot touches.

As I had other things to think of I am not sure if I observed accurately the manner of climbing, but she appeared to me to swarm up with her belly close to the tree and her legs well round the bole.

A man I had as a stop in a tree 100 yards off was loud in his lamentations, and was with difficulty convinced I was unhurt. He then somewhat inconsequently remarked that I was his father and his mother.

SECOND LIST OF CHIN-LUSHAI BUTTERFLIES.

By Lionel de Nicéville.

This list is a little larger than the one previously given, and is more interesting, as in many cases the exact localities where the specimens were captured and the dates of capture are given. The species enumerated were collected by Mr. F. E. Dempster, of the Telegraph Department, during the Chin-Lushai Expedition of 1889-90. The species recorded are deposited in the Museum of the Bombay Natural History Society.

"Note.—The specimens for which the dates and locality of capture are not given were found generally distributed along all the streams. *D. chrysippus* was found everywhere, also *D. genutia*. Noted at Bwetet as it was high on the hills. *E. godartii* general. *M. runeka* common everywhere. *Ypthima* common everywhere *Elymnias undularis* only found on low ground, not on the high hills at all. I saw no specimens of this over 1,000 feet above sea level."—(*F. E. Dempster.*)

Family NYMPHALIDÆ.

Subfamily Danainæ.

1. *Danais melanoides*, Moore.
   Laivar Stream, 27-3-90.

2. *Danais melaneus*, Cramer.
Lamtok, 6-4-90.
3. *Danais chrysippus*, Linnæus.
4. *Danais genutia*, Cramer.
Bwetet, 8-2-90.
5. *Euplœa midamus*, Linnæus.
Lamtok, 6-4-90; Kan, 8-1-90.
6. *Euplœa godartii*, Lucas.

Subfamily SATYRINÆ.

7. *Mycalesis runeka*, Moore.
9-12-89.
8. *Mycalesis mineus*, Linnæus.
9. *Mycalesis perseus*, Fabricius.
Maw Valley, 2-1-90.
10. *Mycalesis rudis*, Moore.
Yokwa, 3-2-90, 11-3-90; Rawvan, 27-3-90.
11. *Lethe europa*, Fabricius.
19-3-90.
12. *Lethe dyrta*, Felder.
Toungtek, 17-3-90.
13 *Lethe rohria*, Fabricius.
Toungtek, 17-3-90; Laivar, 27-3-90.
14. *Ypthima huebneri*, Kirby.
15. *Melanitis leda*, Linnæus.
Thilin, 10-12-89; Maw Valley, 1-1-90.
16. *Melanitis bela*, Moore.
17. *Melanitis zitenius*, Herbst.
Kan, 8-1-90, 19-3-90.

Subfamily ELYMNIINÆ.

18. *Elymnias undularis*, Drury.
Lounghut, 19-3-90.

Subfamily NYMPHALINÆ.

19. *Ergolis ariadne*, Linnæus.
20. *Cupha erymanthis*, Drury.
Choungkwa, 24-3-90, 25-3-90.

21. *Atella sinha*, Kollar.
Lamtok, 6-4-90; Choungkwa, 24-3-90.

22. *Atella phalantha*, Drury.
Bwetet, 8-2-90; Lounghut, 19-3-90.

23. *Cethosia cyane*, Drury.

24. *Apatura namouna*, Doubleday.
Lamtok, 5-4-90.

25. *Hestina nama*, Doubleday.
Choungwa, 25-3-90; Toungtek, 17-3-90; Laivar, 27-3-90; Lamtok, 6-4-90.

26. *Precis iphita*, Cramer.
Menoo, 12-2-90; Bwetet, 3-2-90.

27. *Junonia lemonias*, Linnæus.

28. *Junonia hierta*, Fabricius. This specimen noted, as Haka is over 6,000 feet.
Haka, 15-2-90.

29. *Junonia orithyia*, Linnæus.
Menoo, 12-2-90.

30. *Neptis hordonia*, Stoll,
Laivar, 31-3-90.

31. *Neptis varmona*, Moore.
Bwetet, 8-2-90; Lamtok, 6-4-90.

32. *Neptis ophiana*, Moore,
Lounghut, 19-3-90.

33. *Argynnis niphe*, Linnæus.
Haka, 23-2-90.

34. *Lebadea attenuata*, Moore.
Kan, 8-1-90; Lamtok, 6-4-90. Found in same localities and not elsewhere as *E. undularis*.

35. *Athyma perius*, Linnæus.
Menoo, 12-2-90.

36. *Athyma opalina*, Kollar.
Rawvan, 27-3-90.

37. *Athyma selenophora*, Kollar.
25-3-90.

38. *Symphædra dirtea*, Fabricius.

39. *Euthalia lepidea*, Butler.
Maw Valley, 1-1-90, 2-1-90.

40. *Vanessa canace*, Linnæus.
Menoo, 12-2-90; Yokwa, 3-2-90. Over 3,000 feet above sea level.

41. *Cyrestis thyodamas*, Boisduval.
Lamtok, 6-4-90.

42. *Kallima inachis*, Boisduval.
Laivar, 27-3-90; Lamtok, 6-4-90.

43. *Charaxes athamas*, Drury.
25-3-90.

44. *Charaxes arja*, Felder.

45. *Charaxes fabius*, Fabricius.
Lounghut, 19-3-90.

46. *Charaxes harpax*, Felder. Yokwa 3-90. 1,000 feet below Yokwa.

47. *Charaxes hierax*, Felder.
Yokwa, 25-3-90; Choungkwa, 23-3-90.

48. *Charaxes endamippus*, Doubleday.
Lamtok, 6-4-90.

Family LEMONIIDÆ.

Subfamily LIBYTHÆINÆ.

49. *Libythea lepita*, Moore.
Bwetet, 8-2-90; Haka, 19-2-90.

Subfamily NEMEOBIINÆ.

50. *Zemeros flegyas*, Cramer.
Menoo, 12-2-90.

51. *Abisara suffusa*, Moore.
Bwetet, 8-2-90.

52. *Dodona ouida*, Moore.
Menoo, 12-2-90; Haka, 15-2-90.

Family LYCÆNIDÆ.

"The majority of the *Lycænidæ* were caught on the Poungdaung Range near Paut, about 1,500 feet above sea level."—(*Dempster.*)

53. *Chilades trochilus*, Freyer.

54. *Zizera otis*, Fabricius.

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55. *Jamides bochus*, Cramer.
Thilin, 9-12-90; Myittha River Rapids, 19-4-90.
56. *Lampides elpis*, Godart.
57. *Lampides ælianus*, Fabricius.
Choungwa, 25-3-90; Thilin, 9-12-89.
58. *Catochrysops strabo*, Fabricius.
59. *Catochrysops pandava*, Horsfield.
60. *Tarucus plinius*, Fabricius.
61. *Castalius rosimon*, Fabricius.
62. *Castalius ethion*, Doubleday and Hewitson.
63. *Arhopala dodonæa*, Moore.
Lamtok, 6-4-90.
64. *Curetis bulis*, Doubleday and Hewitson
Lounghut, 19-3-90.
65. *Ilerda epicles*, Godart.
Laivar, 27-3-90.
66. *Aphnæus syama*, Horsfield.
67. *Hypolycæna erylus*, Godart.
68. *Cheritra freja*, Fabricius.
69. *Catopœcilma elegans*, Druce.
Lounghut, 19-3-90.
70. *Loxura atymnus*, Cramer.
71. *Rapala melampus*, Cramer.

Family PAPILIONIDÆ.

Subfamily PIERINÆ.

72. *Nichitonia xiphia*, Fabricius. Common everywhere.
73. *Mancipium canidia*, Sparrman.
Boinu River, 25-2-90.
74. *Huphina phryne*, Fabricius.
Laivar, 31-3-90.
75. *Appias hippoides*, Moore.
76. *Appias zelmira*, Cramer.
19-4-90.
77. *Prioneris thestylis*, Boisduval.
Yokwa, 3-2-90.

78. *Terias hecabe*, Linnæus. Common everywhere.

79. *Catopsilia crocale*, Cramer.

80. *Hebomoia glaucippe*, Linnæus. Common everywhere.

81. *Nepheronia gæa*, Felder. Common everywhere.
Kan, 8-1-90; Maw Valley, 2-1-90.

82. *Delias agostina*, Hewitson
Kyin, 30-12-89.

83. *Delias descombes*, Boisduval.
Laivar Stream, 27-3-90.

84. *Delias pasithoë*, Linnæus. ⎫
85. *Delais pyramus*, Wallace. ⎭ Rawvan.

"These were the only species of *Delias* I saw, and I only saw very few more specimens."—(*Dempster*.)

Subfamily PAPILIONINÆ.

86. *Ornithoptera pompeus*, Cramer.
Lamtok, 6-4-90.

87. *Papilio nomius*, Esper.
Lounghut, 19-3-90.

88. *Papilio eurypylus*, Linnæus.
25-3-90; Lamtok, 6-4-90.

89. *Papilio philoxenus*, Gray.
Laivar, 27-3-90; Boinu River, 25-2-90

90. *Papilio polytes*, Linnæus.
8-3-90.

91. *Papilio machaon*, Linnæus.
Haka, 15-2-90.

92. *Papilio paris*, Linnæus.
Lamtok, 6-4-90; Choungkwa; 18-3-90.

93. *Papilio dissimilis*, Linnæus.
Lounghut, 19-3-90; Bwetet, 8-2-90, 25-3-90

94. *Papilio onpape*, Moore.
Laivar, 31-3-90; Lounghut, 19-3-90.

95. *Papilio androgeus*, Cramer.
Maw Valley, 2-1-90.

Family HESPERIIDÆ.

96. *Chapra prominens*, Moore.
Bwetet, 8-2-90 ; Yokwa, 3-2-90, 5-3-90.

97. *Chapra mathias*, Fabricius.
Bwetet, 8-2-90.

98. *Udaspes folus*, Cramer.
Laivar, 31-3-90 ; Haka, 22-2-90.

99. *Padraona mæsa*, Moore.
Laivar, 31-3-90.

100. *Parnara bevani*, Moore.
Bwetet, 11-2-90.

101. *Antigonus sura*, Moore.
Choungkwa, 25-3-90.

102. *Astictopterus salsala*, Moore.

ÆNICTUS (*TYPHLATTA*) AND SOME NEW GENERA OF FORMICIDÆ.

By Auguste Forel, Professor at the Zürich University.

(*Translated by R. C. Wroughton, Poona, from the Proceedings of the Société Entomologique de Belgique, 7th June,* 1890.)

Shuckard first advanced the theory that the supposed family of *Dorylidæ* contained the males only of certain ants. Shuckard argued most truly, and divined the truth in spite of the opposition of Westwood and others. The discoveries of Gerstaecker, Trimen and others have confirmed the fact that the *Typhlopone* (West.) are only the ☿ (workers) of *Dorylus*. Further, the remarkable observations of Wilhelm Müller at Itajahy, and the discovery of Hetschks have confirmed the analogous hypothesis of Sumichrast and Smith, and have shown that the *Labidus* of America are only the ♂ (males) of *Eciton*, even though the *Labidus* have only one knot in the pedicle, and that the *Eciton* with their pedicle of two knots had till then been classed as *Myrmecidæ*. There remain the genera *Ænictus* and *Rhogmus* of the *Dorylidæ*, of which the ☿ has so far remained unknown. By analogy it could be surmised that the genus *Typhlatta*

(Smith) must represent the ☿ of *Ænictus*. *Ænictus* and *Typhlatta* inhabit tropical Asia, and have affinities analogous to those between *Labidus* and *Eciton*.

Emery (*Bulletin de la Soc. entom. ital.*, 1887) advanced this hypothesis, which for that matter was self-evident once the ☿ of *Dorylus* and *Labidus* were known.

Mr. R. C. Wroughton, Divisional Forest Officer, Poona, having sent me last year *Ænictus ambiguus* (Shuck.) and a new *Ænictus*, I called his attention to the interesting problem of the ☿ of *Ænictus*.

I have just received from Mr. Wroughton a third species of *Ænictus*, in company with a new species of *Typhlatta* taken together. The problem is therefore solved, and the honour belongs to Mr. Wroughton, who writes laconically and prudently:—"There are some, what seem to me to be, *Ænictus*, n. sp., taken by Mr. Gleadow in Thana. Had I been there I might have settled the question of the ♀ and ♂, but I have failed to find a nest so far."

The result of this important discovery is that the genus *Typhlatta*, Smith, (1858, *Proc. Linn. Soc. Zool.* II.) must be dropped as a synonym of the genus *Ænictus*, Shuckard (*Ann. and Mag. Nat. Hist.*, vol. V., 1840, p. 266).

The capture of the *Ænictus Wroughtonii*, with its ☿ was made on 31st March, 1890. This date is most important as giving the time of the year at which there is a likelihood of finding the winged ♂ in the nest. As in the genus *Eciton* the ♂ has one knot and the ☿ two knots in the pedicle (*i.e.* of the abdomen).

GENUS ÆNICTUS, *Shuckard* (*Ann and Mag. Nat. Hist.*)
=TYPHLATTA, Smith (*Proc. Linn. Soc., Zool.*, 1858).

Ænictus Wroughtonii, n. sp.

☿ Length 2·5 mm. Narrow and rather elongate. Head narrow, elongate, the sides rather convex, and the posterior edge short and rather rounded as in *Æ. læviceps*; but the head is much narrower and longer than in that species. Anterior edge of epistome crenelate or denticulate, not entirely hidden by the frontal ridges. No distinct frontal groove. Terminal edge of mandibles rather long, microscopically denticulate, with one stout tooth at the extremity.

Mandibles smooth, shining, with some hair-bearing pits. The antennæ are rather long; the joints of the funiculum are all longer than broad, as in *Æ. læviceps* (joints 3 and 4 twice as long as broad)· Thorax long, narrow, strongly, and, for some distance, constricted in the posterior portion of the mesonotum; its dorsal profile is strongly hollowed; the depression is markedly long, and divides the thorax exactly in two parts. Pro-mesonotal suture obsolete. Basal area of the metanotum convex, very narrow, compressed; the small sloping area entirely surrounded by a ridge. First knot of pedicle compressed, rounded, higher behind than in front, nearly three times as long as broad, slightly convex beneath but not toothed. Second knot rounded, scarcely longer than broad, with a very small tooth beneath, in front. Pygidium rather overhung by the penultimate abdominal segment.

Whole insect smooth and very shiny, except the sloping area of the metanotum, which has some very fine transverse wrinkles. Half-erect, rather oblique, pale yellow, short, pointed hairs abundant on the legs and antennæ, less so on the body; almost no pubescence.

Whole insect a shining yellow, somewhat transparent; faintly reddish or brownish.

♂ Length 5·3 mm. The joints of the funiculum of the antennæ are all cylindrical and much longer than broad, except the 1st scapes, thighs, and femoral rings depressed (flattened), but nevertheless somewhat elongate; the scapes are triangular as in *Æ Feæ* (very broad at the tip, narrow at the base); tibiæ are similarly shaped, but are only slightly flattened and less enlarged at the tip. The thighs are as broad and flattened at the base as at the tip (in *Æ. Feæ* they are only flattened at the tip). The mandibles are rather long and broad, nearly as broad near the tip as at the base, terminating in a blunt point, smooth, shining, hairy, evenly and moderately curved. The head is not much broader than long; the eyes only occupy the anterior two-third of its sides. The head is narrowed behind the eyes, but its lateral edge is there distinct from the occipital edge. Frontal ridges rather close together, rather closer together than the inner edge of the mandibles. The ocelli are not very large, and are not placed on a special eminence. The face between the eyes seen from above shows as a very feeble transverse concavity. The mesonotum does not overhang the pronotum, but is strongly convex and reaches to the anterior limit of the thorax. Pedicle with only one knot, much broader than long, concave beneath, anterior and posterior edges concave, the latter much broader than the former; sides convex, converging anteriorly. The two halves of the pedicle form as it were two wings as in the other species of the genus. Beneath, the pedicle is armed with a large tooth, very long, and very thick, and ending in a blunt point; the anterior face of this tooth is oblique, its posterior vertical (very slightly curved backwards).

The whole body smooth and shining, with very fine, scattered hair-bearing pits, wanting in places.

Pubescence greyish-yellow, rather long, more or less all over the body. On the pedicle it forms a greyish nap, on the thorax the pubescence is much less close and permits the sculpture to be seen. On the abdomen the pubescence is shorter and very sparse, while on the head and on the sloping area of the metanotum it is almost absent. On the face, and the underside of the body (especially of the pedicle) and on the thighs are long curved hairs. There are some few somewhat scattered erect hairs on the legs, otherwise there are no erect hairs.

Black tinged with brown. Extremity and underside of the abdomen, tooth of the pedicle and antennæ of a reddish- or yellowish-brown. Legs and periferal half of mandibles yellow-testaceous.

Wings faintly tinged with brown, finely pubescent, with the marginal spot and the nervures blackish-brown. The radial cell closed. The transverse nervure is long, and joins the outer cubital branch close to its starting point.

Thana, 31st March, 1890, ☿ and ♂ taken together.

This species is distinguished by the hollowed thorax, slender and very elongate form, and smooth and shining metanotum of its ☿. The ♂ is also very distinct from the species already described.

Genus TRIGONOGASTER, n. gen.

General aspect of a *Pheidole* ☿. Antennæ 11-jointed; club three jointed, the club is as long as the rest of the funiculum; the last joint is if anything longer than the two preceding combined, the penultimate is thicker, but barely longer than the antepenultimate, which is twice as long as the 7th joint. Maxillary palpi 5-jointed, labial 3-jointed. Mandibles armed with 4 stout teeth. Epistome strongly vaulted, furnished with 2 longitudinal ridges, it forms posteriorly a boss between the frontal ridges, which are short, but fairly high. Frontal area narrow and deep; frontal groove short. Eyes placed rather in front of the sides of the head. Thorax constricted behind the mesonotum; pronotum and mesonotum moderately vaulted, the latter rather the more so; the former more flattened and narrower than in *Pheidole*. Metanotum armed with 2 stout spines, elegantly curved forward. The first knot of pedicle with a rather long and anteriorly broad petiole; this petiole, somewhat concave above and convex beneath, is furnished beneath, anteriorly, with a small tooth, and posteriorly with a somewhat small, conical, squamiform protuberance. The second knot is very low, broader than long, rounded anteriorly, and broadly attached posteriorly to the abdomen. Abdomen small; seen from above it is narrow in front, and feebly enlarged to the end of the first segment. The other segments appear only as a small cone projecting beyond the first segment. Side view, the abdomen is triangular, the sides of the triangle are somewhat convex. The profile forms an isosceles triangle, of which the base, formed by the flattened upper surface of the abdomen, is longer than the two sides. The summit of the triangle (more properly of the cone), is almost in the middle of the underside of the first segment, which of itself constitutes nearly the whole ventral (as it does the dorsal) surface. Erect hairs of the body toothed and blunt as in the genus *Leptothorax*.

This singular ant is closely allied to the genus *Pheidole*, but there was no " soldier" among the specimens sent me by Mr. Wroughton. Otherwise the head is smaller, and the club of the antennæ recalls only that of certain aberrant species. The species of *Pheidole* have 12-jointed antennæ, except *Ph. quadrispinosa*, which has 11. However, the singular form of the abdomen, the form of the epistome, and the low and narrow pronotum isolate this insect sufficiently to found on it a genus. All the ☿ seem to be the same size.

Trigonogaster recurrispinosus, n. sp.

☿ Length about 2 mm. Characters of the genus. Head nearly square, slightly longer than broad, hollowed posteriorly, the sides faintly convex. The scape does not quite reach the posterior edge of the head. Mandibles narrow, crossed, the terminal edge short, armed with 4 stout teeth. Epistome truncate anteriorly, very high and vaulted posteriorly. The eyes have rather straight lateral edges, and the anterior extremity almost pointed. Mesonotum small. Pro-mesonotal suture faint; meso-metathoracic constriction considerable. Basal area of the metanotum horizontal, narrow, much longer than broad, longer than the sloping area. Knot of first joint of pedicle attenuate at its summit.

Mandibles rugose, rather shiny. The whole body, from one end to the other, including the sloping area of the metanotum, densely and finely reticulate-punctate, and lustreless or almost sub-opaque. Legs and scapes reticulate. Some coarser longitudinal wrinkles on the cheeks.

Pubescence sparse, short on the whole body, slightly more abundant on the legs and scape; the recumbent hairs are curved. The erect hairs very sparse, stiff, blunt, rather short; the erect hairs (except about the mouth and under the abdomen) are very distinctly denticulate under the microscope, which gives them a somewhat ragged look under a magnifying glass; they are identical with those of the genus *Leptothorax*.

Reddish yellow; legs, mandibles, antennæ, pedicle, and abdomen a paler yellow. A brownish band very indistinct and interrupted in the middle of the abdomen.

Poona (India), collected by Mr. R. C. Wroughton.

Genus EMERYIA, n. gen.

☿ Mandibles very long, very narrow, without a terminal edge, nearly straight for the basal half, curved beyond, terminating in a long sharp point, slightly broadened and flattened about the middle, narrowed near the base, without any trace of teeth. They leave between them a large empty space, and resemble those of the "soldier" of *Myrmecocystus bombycinus*. Epistome furnished with two keels, hollowed and deeply grooved between. This groove is produced between the frontal ridges, and as a frontal groove as far as the middle of the vertex. No ocelli. Head broadened and rounded posteriorly, narrowed anteriorly; it has however a posterior edge; eyes rather small, situated in the anterior one-third of the head. Frontal ridges rather short. Antennæ 11-jointed; the last joint, very large and very thick, alone forms the club. The scape is far from reaching the posterior edge of the head. The pronotum has two distinct shoulders, and forms anteriorly near its articulation distinct steps. The mesonotum is short and very broad; its lateral edge forms on each side a triangular protuberance like a large festoon. Metanotum armed with two short spines. Pedicle as in the genus *Cardiocondyla*. The first joint is petiolate anteriorly, and has a flattened knot, longer than broad. The second joint is broad, broader than long, narrowed and concave anteriorly, slightly less narrowed and concave posteriorly, rounded at the sides, flattened above, furnished beneath with a blunt tooth. Abdomen truncate anteriorly.

By its mandibles this genus, otherwise closely allied to *Cardiocondyla*, differs from all other *Myrmecidæ*. It differs also from *Cardiocondyla* by its 11-jointed antennæ and its mesonotum.

Emeryia Wroughtonii, n. sp.

☿ Length 1·7 mm. Characters of the genus. Mandibles smooth and shining. Head, for the most part, smooth and shining, with some large, sparse, hair-pearing pits, somewhat effaced and somewhat rough at the bottom. These pits are more abundant on the forehead, and are accompanied by a few very short and fine striations. Back of thorax bounded by a faint rim. Pro-mesonotal suture nearly obsolete; meso-metanotal suture very deep, but without any constriction between the meso and meta-thorax. Basal area of metanotum more or less horizontal, much longer than broad. Spines rather short and rather blunt. Thorax irregularly reticulate, punctate, and nearly lustreless, the lateral expansions of the mesonotum give it a peculiar aspect. Abdomen and pedicle rather smooth, shining, very finely and very sparsely punctate.

The whole body, the legs, and the antennæ rather abundantly furnished with pale yellowish, rather long, pubescence, which, however, does not form a nap. Erect hairs almost absolutely absent.

Pale testaceous-yellow; mandibles reddish; abdomen brownish-yellow.

This curious ant (a single ☿) was found by Mr. R. C. Wroughton, at Poona, with a new species of *Cardiocondyla*, which lives in blisters on the leaves of *Eugenia jambolana* (blisters probably caused by small grubs). Is it, as I am led to believe, a case of symbiosis, analogous to that of *Strongylognathus*? Is it a lusus naturæ? Or is it possible that *Emeryia* is the 'soldier' of *Cardiocondyla*? This last supposition seems to me most improbable; the other species of *Cardiocondyla* have no 'soldiers,' and antennæ in that genus are 12-jointed.

Genus TRIGLYPHOTHRIX, n. gen.

☿ short, stoutly built. Antennæ 12-jointed; club composed of three unequal joints. Epistome as in the genus *Tetramorium*; its posterior edge raised and curved backwards forms anteriorly, as a ridge, the boundary of the antennal groove. Frontal ridges wide apart, nearer the outer edge than the median line of the head; they are produced backwards almost to the posterior angle of the head. Between the eyes is a wide and deep double groove, which serves to lodge both the scape and funiculum of the antennæ; to this end, this groove is bounded laterally by a ridge which, commencing from the anterior angle of the head, touches the interior edge of the eye, and going backwards in a curve is lost in the posterior extremity of the produced frontal ridge. The double groove is moreover divided longitudinally for the anterior three-fourths or four-fifths of its length by a ridge which separates the grooves in which are lodged the scape and funiculum respectively; anteriorly this dividing ridge terminates a little to one side of the posterior recurved edge of the epistome. The back of the thorax broad, bounded by a faint ridge. Sutures obsolescent. Metanotum two-spined. Meta-sternum bi-dentate. Knots of the pedicle very broad; the first shortly petiolate. Abdomen truncate and notched anteriorly, almost entirely covered by its 1st segment, which is bounded by a very faint ridge, especially anteriorly.

The hairs with which the body and extremities are abundantly covered have a peculiar structure; from the bottom of each hair bearing pit starts the stem of a hair which almost immediately divides into three diverging branches, rarely more or less. This multiplicity of trifid hairs gives a general woolly aspect to the insect.

Otherwise resembles the genus *Tetramorium*, though not without a certain likeness to the genus *Meranoplus*. The genus *Triglyphothrix* is thus to some extent a connecting link between the *Myrmicinæ* and the *Cryptocerinæ.* The workers have a tendency to roll themselves into a ball. From this fact, it seems to me, that *Meranoplus* is descended from the *Myrmicinæ* through the type *Tetramorium.* The genus *Triglyphothrix* also resembles the genus *Calyptomyrmex* (Emery).

♀ like the ☿, and only slightly larger than it. Wings with a single open radial cell. The transverse nervure joins the cubital nervure at the point where it forks.

Triglyphothrix Walshi, n. sp.

☿ Length 1·9 to 2·4 mm. The mandibles armed anteriorly with three distinct teeth and posteriorly with three others, small and indistinct, shining, with some coarse punctures and a few short, coarse striures. Frontal area and groove absent. Epistome coarsely wrinkled. The whole head lustreless, very coarsely and deeply reticulate (at the sides and beneath) or longitudinally rugose-reticulate, except the bottom of the double antennal groove, which is shining and finely rugose-reticulate. The head is in shape a trapeze, with only slightly diverging sides, broader behind than in front, broadly and feebly notched posteriorly, slightly longer than broad. Thorax very short and very stout, rather shorter than the head, its back very faintly edged, but with two well-marked "shoulders" anteriorly, feebly convex. Basal area of the metanotum somewhat sloping. The pronotum is as broad as two-thirds the length of the thorax. Metanotal spines three-cornered, broad at the base, shorter than the distance between them. The sloping area of the metanotum shining, with two or three marked transverse wrinkles, bounded by small ridges anteriorly and laterally. The two small lamelliform metasternal teeth are continuations of this ridge. All the rest of the thorax and the pedicle (except the petiole of the first knot) deeply and coarsely reticulated and lustreless. The two knots of the pedicle are of the same length, breadth, and rounded form; they are twice as broad as long; the first is a trifle higher than the second. Abdomen a short oval; the anterior half of first segment is lustreless, densely striate longitudinally. The striures are frequently crossed by short transverse ridges, which extend from one side to the other, and which represent a hair-bearing reticulation, of which the posterior side has disappeared. The remainder of the abdomen and the feet are smooth and shining; the scapes are rugose-reticulate. The bottom of the coarse reticulations on the head, thorax, and pedicle contain a small elevation, from which starts a trifid hair.

The characteristic trifid hairs are somewhat short, yellowish-white, fairly evenly and abundantly scattered, not only over the whole body but also on the thighs and tibiæ. The tarsi and antennæ have scarcely any but simple, semi-recumbent hairs.

Brown. Abdomen dark brown, somewhat blackish. Feet, antennæ and mandibles yellowish-brown.

♀ Length 2·7 to 3·0 mm. Basal area of metanotum nearly vertical, shining, longitudinally wrinkled. Mesonotum rugose, reticulate longitudinally. Striate portion of abdomen shorter than in ☿, the remainder of the abdomen is covered with a fine, sparse hair-bearing punctuation, more distinct than in the ☿. Thorax a little narrower than the head, short. Abdomen small. Wings almost hyaline, faintly tinted with yellow, finely pubescent. Nervures and marginal spot very pale. Otherwise exactly like the ☿.

Poori, Bengal, by Dr. Jul. Walsh.

Poona, Bombay, by Mr. R. C. Wroughton.

Nests underground. Winged ♀ taken by Dr. Walsh in second half of June.

This species is not wanting in affinity to *Tetramorium obesum* (André), but notwithstanding the absence of mesonotal spines, it is almost as closely connected with *Meranoplus bicolor*. Among the evidences of this relationship must not be omitted the tendency of the basal area of the metanotum to assume a sloping position, nor the form of the pedicle of the abdomen.

BOMBAY GARDENS.

By G. Carstensen, Superintendent of Municipal Gardens, Bombay;
Gr. Hort. R. D. Agr. Coll. (Copenhagen).

(Read at the Bombay Natural History Society's Meeting on 3rd December, 1890.)

The object of the present paper is to give a general outline of gardens in Bombay, to point out the features by which they are principally remarkable, and the peculiar circumstances under which they have been formed and are kept up. All this is well-trodden ground for most of the Bombay inhabitants, who, I hope, will forgive me in dealing with the subject in a way more calculated to be of interest for those to whom Bombay gardens are not yet an object of daily enjoyment, than for those who are already familiar with their advantages and defects. Every European arriving in this country brings with him the memory of the perfection which the love of plants and vegetation has caused our gardens at home to attain, and with the natural and human constant desire for, and belief in, something better, he carries with him illusions of the beauty, glory, and wealth of the tropical vegetation in which he often believes to find a paradise on earth. He may be, and generally is, disappointed, or rarely, the luxuriance of the vegetation may appear to him even greater than anticipated, so much depends on the season at which he arrives, or on the locality in which he settles down. In one respect, however, he is always sure to be disappointed—in the expectation of a wealth of flowers. This question has been so excellently dealt with by the distinguished writer and traveller, A. R. Wallace, in that delightful book, "The Malay Archipelago," and other writings, that I shall not tire my audience by a mere repetition, though I may remark that this observation principally refers to the indigenous flora. Gardening, however, here comes to our resource; and by the introduction of numerous exotic plants, chiefly inhabitants of tropical America and Madagascar, it has been made possible to ensure a constant supply of flowering plants in Bombay; and with care it is feasible to grow a great many plants, whose flowers are old friends from home. It is only human and natural that our impressions from childhood and youth should be so strong, that we will always retain a preference for those objects which in those happy periods of life have fixed themselves in our memory; and so it is with flowers. Even if we later on in life meet with the most gorgeous or splendid floral beauties, we cannot help admiring them; but still the memory of our homely flowers, which is often associated with thoughts of the dearest and happiest events of our life, will always overshadow the splendour of even the most dazzling flowers we come across. We will constantly miss the violets, anemones, primroses, cowslips, bluebells, lilies of the valley, and other gems from meadow and wood, the roses, rhododenrons, syringus, laburnums, hawthorn, fruits, trees, from the gardens; the Azaleas, Primulas, Ericas, Fuchsias, Pelargoniums, and numerous other plants from our green-houses; and even if we succeed in producing some of these here, they are so inferior to what we used to see, that we cannot help being disappointed. It is natural but doubtfully recommendable for all Europeans arriving in a new, even distant country, to surround themselves, as far as possible, with the same moveable objects, which in their home were their daily companions, to retain the same dress, the same fashions, the same distribution of working and leisure-hours, and even to make no alteration in their diet. This may be a sign of the love for our homes, but may perhaps in many instances be attributed to a certain amount of pride, an unwillingness to submit ourselves to the influence of other customs, or even to the dictates of nature, a feeling which, when strictly adhered to, is but too often punished by ill-health, uneasiness, discomfort, and often grave disappointments, which in many cases might have been avoided. As is the case with ourselves, so it is with the plants which used to surround us at home, with this difference, though, that even when hailing from less distant countries, they are much more tender subjects, and have far greater struggles to contend with in a new country. Their dependence on temperature, rainfall, and other climatic agencies is so great, that the least change will, in many instances, seriously affect them; and we are to a certain extent ourselves to blame, when their cultivation cause us disappointments, which we by a bit of reasoning might have anticipated. It is, however, not my intention to argue against the cultivation of such plants, but only to warn against too sanguine expectations; while, on the other hand, I should advise everybody not to be discouraged by unsuccessful results, but to persevere in their efforts, guided by the peculiar local conditions more than by the requirements of the plants at home, by which means only it will be possible to eventually acclimatise such plants and obtain better results in future. I have already dwelt too long on the disappointments of gardening in Bombay for Europeans; it is therefore only fair to notice the advantages. Then I have no hesitation, regardless of home associations, to pronounce Bombay as one of the most "highly-favoured" localities for gardening. It is not only possible to have a magnificent display of flowers at almost all seasons of the year, but the luxuriance of an enormous variety of foliage plants, peculiar for the grandeur or gracefulness of their features, or for the brightness and variety of their colour, can hardly be surpassed in any other country in the world. The origin of the plants, commonly met with in Bombay gardens, speaks volumes for the keen interest and enterprise in the introduction of new plants, which has, for year after year, distinguished the inhabitants of this city, and to whom it is mainly due that we can now unflinchingly protest against the first statement of our old friend "Firminger," namely, this: "Under the most favourable point of view it can hardly be said that horticulture has as yet made much advancement in India." It is a remarkable fact that comparatively few of our garden plants are of indigenous origin; but that by far the greatest and most effective proportion hail from tropical America, Madagascar, East Africa, the Malay Archipelago and South Sea Islands, a number from Ceylon, Northern India, Japan, and China, and a few from Australia, South Africa, and Southern Europe, but hardly any from extra tropical America or even from the west side of South America. But, as far as my experience goes, I do not think it improbable that by far the majority of plants indigenous in tropical India, British Guiana, Brazil, Columbia, West Indies, Tropical Africa, South Sea Islands, Java, Phillipines, Ceylon, Malay Peninsula, Burmah, and the Lower Himalayas, and perhaps tropical Australia, will have a good chance of success in Bombay. If this should hold good it will be seen what a wide field there is still left for the future introduction of plants, of which but comparatively few have hitherto been introduced to Europe. If, therefore, any member of our Society should happen to have friends resident in any of these countries, they would do a most valuable service to gardening in Bombay, and to botany generally, by requesting them to send them seeds of indigenous plants from such places, outlying districts in India not excepted. The peculiarities of the climate of Bombay must necessarily be known in order to enable us to form a judgment of the probable successful cultivation of plants from different countries. I shall therefore shortly summarise its main features, though they must be familiar to most of those present. It will then first be observed that the actual temperature is not so high as the geographical situation of Bombay might lead us to expect, the thermometer showing a range between a maximum of 93 degrees and a minimum of 63 degrees, while the average temperature of the year is 79·7 degrees, figures that as nearly as possible coincide with the temperature generally maintained in our stoves or hothouses at home. The humidity of the atmosphere is at all times of the year very great, owing to the immediate neighbourhood of the sea, which, on the other hand, causes the air to contain a certain amount of salt or sodium chlorine, which for certain plants is undoubtedly beneficial, but not improbably may be a disadvantage for other plants. Though the Bombay climate does not present such distinct variety throughout the year, as that of our northern homes, which can easily be distinguished into four seasons, it is, however, usual to divide it into three seasons—the cold, the hot, and the wet season. The cold season generally lasts from November to March, and is characterized by fine bright weather with gentle N., N.N.W., N.W., W., or N.N.E., but in Bombay rarely, E. breezes, a comparatively low night temperature (the difference between night and day temperature often exceeding 20 degrees), which, as a contrast to the heat in the sun, which is often as much as 50 degrees higher than the temperature in the shade, will often prove very trying for plants. The heavy dew, which is caused by this great difference in night and day-temperature, on the other hand, acts as a natural protection against the sudden changes of temperature, by checking evaporation, and at the same time supplying a certain amount of moisture to the soil. This season is generally considered the most satisfactory for our gardens. The lower temperature makes it possible to raise seedlings of annuals from colder climates, and to produce a tolerably good show of flowering plants. A great many tropical plants, trees, and shrubs produce their flowers during this season, while roses, geraniums, and other extra-tropical plants produce better flowers at this season than at any other time of the year. Many plants will grow very rapidly, while others will be resting during this period. In March the weather commences to get hotter, the difference between night and day-temperature decreases, the dew diminishes, the wind takes a more easterly direction, and the hot season sets in. The humidity of the atmosphere is rapidly decreasing, and strong winds assist the burning rays of the sun in preparing the rest for indigenous plants, which now in many cases shed their leaves, but often only a few days after are covered with brightly-coloured flowers, or with new light green foliage. Though our gardens are least attractive during this season, they are yet not destitute of something beautiful to catch the eye, and even if many of our cherished plants assume a sickly or blighted appearance, this is not necessarily calculated to cause any fear, as in most cases the faded splendour is more certainly an indication of rest than a sign of serious injury. In the course of May the wind loses its force, the air becomes sultry, the sky clouded, and the atmosphere intensely moist, until, generally preceded by a few heavy thunderstorms with heavy rain, the wind rises again, now blowing from the S. W. with slight vacillations to S. and W., and the monsoon or rainy season has set in, as a rule, in the first or second week of June, and continues to the end of October. The average yearly rainfall of Bombay (Byculla) is 82·7 inches, or nearly seven feet, which frequently falls very irregularly. Falls of 5-6 inches in a day are not at all unusual, and very often a heavy downpour lasts for several days in succession, while at other times the weather remains more or less cloudy with occasional heavy showers, or a "break" of fine clear weather, which at times may last for a week or two, sets in. This season is the period in which the tropical character of the climate is most fully pronounced. The luxuriance and formidable growth of all foliage plants, the splendid colours of their leaves, and the profusion of choice and delightfully scented flowers of a great variety of plants, all combine to make an impression which, once experienced, will never be forgotten, and of which such common features as walls and wells covered with bright emerald green moss and graceful maiden-hair ferns are but poor examples. At the end of October the monsoon generally terminates with heavy thunderstorms, the clouds gradually clear away, and the temperature for a short time increases, while the wind is gradually resuming a more western to northern direction, the humidity of the atmosphere is still very great, owing to the rapid evaporation from the ground, and the air is steamy, until the cold northern winds again refresh us.

The soil of most Bombay gardens is very different from what we are used to see at home. What principally strikes the new-comer is the prevalent red colour of the soil of our hills, and many people will, no doubt, at the first sight, think the colour an objection to its fertility as indicating a presence of iron. I have not been able to find any report on its exact chemical contents, but though there can be no doubt that the "red earth" contains a considerable percentage of iron salts, it is, on the other hand, certain that these must be comparatively harmless to vegetation, or that their action is so modified by the presence of other valuable matter that they only assist in forming a most valuable and fertile soil, which, in regard to its physical qualities, partakes of the most desirable properties of the varieties of soil known to us from home. It is porous and at the same time retentive, and has, I believe, a great capacity of absorbing power (a property upon which the fertility of a soil principally depends). In the lower lying districts of Bombay, we meet clay, humus and sand, only slightly differing from the same kinds of soil at home, but which it is not possible, even by artificial means, to so enrich as to compare favourably with the red earth of the hills, at least in respect to producing the brilliant colouring of shrubs, &c., for which especially Malabar Hill is justly famed. The Public Health Department has always a large depôt of most valuable manure, by which means it is easy, at a comparatively small cost, to enrich the soil when required. A few words about the legal aspects of gardens in Bombay may perhaps be found useful. In nine cases out of ten the occupant of a house in Bombay is a tenant, and his rights to the garden, out-houses, and other parts of the property, comprised in the compound, are to a certain extent restricted. He will, as a rule, be required to employ a native gardener, or a *mali*, to maintain the existing garden. He may not, without the landlord's permission, cut down any trees or remove any plants once established in the garden, nor remove any part of the ground, be it rock, soil, or other material. In regard to alterations of existing roads, drains or water service pipes, the owner must also be consulted. On the other hand, he is at liberty to plant whatever he likes in the ground, but it must be always borne in mind that, however much the tenant improves the garden, or enhances its value by planting rare or choice plants in the ground, he can never claim any compensation for such additions, and the plants, once in the ground, will for ever remain the property of the landlord. It is principally owing to these causes and to the frequent changes of residence, that most of the Bombay flowering and foliage plants are cultivated in pots or tubs, the only way by which the grower can secure his ownership to the plants. In some compounds, however, the rock is so near the surface, that the available depth of the soil will not allow of any other mode of cultivation. It is, therefore, usually by a change of tenancy that the stock of plants is either sold by public auction or privately bought by the new tenant, who will often experience great difficulty in arriving at a fair valuation of such plants, especially when a new-comer to Bombay. Another difficulty will be to secure a good *mali*. As a general rule one *mali* will be found sufficient to maintain a well-kept garden averaging from 5 to 10,000 square feet in area; for a garden of greater extent an assistant will be required for every additional 10,000 square feet, while for very extensive gardens two men per acre will be found sufficient. The duties of the *mali* are:—(1) To do all kind of garden work; (2) to be responsible for plants, flowers, tools, &c., belonging to the garden; (3) to arrange flowers and plants in the bungalow, besides which, he is often required (4) to wash the verandahs; (5) to carry water to the bungalow, when water is not laid on; and (6) to supply flowers daily, regardless from whence they come. The duties of 4 and 5 should, if convenient, be performed by other servants, as they but too frequently give the *mali* a valid excuse for not performing his special work satisfactorily. With regard to section 6, the *mali* should be strictly scrutinised, as there is no doubt that considerable abuse exists, by the *malis* disposing of the superfluous flowers belonging to their *Sahebs*. The *mali* should commence work at 6 a.m. and leave work at 6 p.m., but no work should be required of him for two hours in the middle of the day. He should be allowed free quarters for himself and family. The pay of the single-handed *mali* varies from Rs. 10 to Rs. 16, and for assistant *malis* from Rs. 8 to Rs. 10. Very few *malis* are able to perform their work satisfactorily without being now and then guided, and though they will at first resent such guidance and be stubborn, they very soon will learn to appreciate it when they find that the *Saheb* or *Mem-Saheb* are their masters in more than name. Should the *mali* be left entirely to himself, he will soon become careless and negligent, and continue to do all kinds of work just as his father did, and his grandfather before him. Unfortunately the *mali* is not a gardener in the right sense of the word, and he has, as a rule, no interest or love for his plants, which he treats quite mechanically, without ever thinking of them as living subjects. He will water a plant whether it is dry or not, that makes no difference to him, he thinks it his duty to water every pot, regardless of its contents, and he often wastes water by continuing to water a plant that has been dead for a long time. He will generally know when and how to propagate plants or to transplant or repot them, how to clip the lawn or grass border ; but it is far from safe to leave him alone in any kind of pruning, or he is sure to disfigure the plant. He knows something about weeding, but his religious superstitions will rarely allow him to uproot certain plants, as the sacred "tulsi" (*Ocymum sanctum*), or the holy "peepul" (*Ficus religiosa*), and should a plant, which he knows not to be a weed, happen to have found its way into a pot or tub, containing quite a different plant, he will sooner allow the former to kill the latter, than ever think of uprooting it. He has a perfect horror for caterpillars, chiefly the hairy ones, and it is only with the greatest reluctance that he consents to pick them off, when told, and unless closely watched he will not willingly destroy them. He will seldom of his own accord think of supporting a plant with a stick or trellis-work before actually necessary, and he will then as a rule choose the thickest possible pole he can find, or the stoutest rope he can get hold of. At first he will probably, if you understand his language—which, by the way, is Mahratti—meet your remonstrances with incredulity, and use all his eloquence, which principally consists in varied repetitions, to persuade you that such and such a thing cannot possibly be done in this country, that this plant must certainly die if you transplant it, or that that one will never flower any more if you prune it, and so on, until he discovers that you are firm and knows more than himself. Then you will find that your labour is not wasted, and that he is willing to learn, and be taught, and that in reality he is less of a blockhead than you might at first believe. One of his favourite games, which in most cases is but a kind of policy, is to simulate a perfect ignorance of your language, even if you talk Mahratti, but if you persevere he will soon understand you, and he will respect you the more, the less knowledge of his language you show him. His ideas of art are generally limited to the acquaintance with the straight line, and its use or abuse in forming squares, diamonds, &c.; you may find him able to draw a circle, but as a rule he is totally incapable of using arcs or curves in laying out gardens or flower-beds. As regards the arrangement of flowers and plants, you will in most cases find it necessary to give him a course of instruction, and he may occasionally attain to great proficiency in this art. The *mali* is, as a rule, honest, sober, and very clean, his religion enforcing two or three ablutions daily.

Having shortly reviewed the different circumstances under which gardening is practised in Bombay, I shall try in the following lines to give a general outline of the most frequent aspect of Bombay gardens. Large gardens are but few, though it is not altogether rare that the compound is extensive, and by a comparatively small expenditure could be made sufficiently attractive to form a picturesque addition to the garden, without exactly requiring the constant and, I regret to say, expensive maintenance necessary for a well-kept garden. I allude here chiefly to such compounds where large rocks or boulders present difficulties for building or levelling, or where toddy palms are retained on account of the profit they yield to the owner, or where the soil is not sufficiently deep to allow of cultivation. Though it is not uncommon that such compounds are naturally picturesque, there is still a large scope left here for the assistance of nature, by the work of the landscape gardener. Most gardens consist simply of a lawn surrounded by a drive leading to the bungalow, and shrubberies concealing the fences of the garden. This simple plan is often carried out with great taste, but in far too many instances the distribution of trees and shrubs is too absurd to please the eye, in which respect I shall only mention the very common practice of hiding the porch of the bungalow with a very dense screen of shrubs or even trees, a practice that may have certain advantages as securing privacy, but, on the other hand, has so many disadvantages that are quite sufficient to condemn it. In the first instance, the circulation of air through the house is prevented, a very important consideration for the healthiness of the house; secondly, the view of the garden from the house is hidden, and part of the object of the garden consequently useless; and, thirdly, the architectural features of the house, if of consequence, are entirely obscured from view. Privacy can be much more effectually secured by a moveable screen. Other gardens, happily now-a-days but few, are laid out in the native style with squares, diamonds, &c., and numerous pathways crossing each other at acute angles. This style, no doubt, can be made to look effective, when planted and maintained with great care and attention; but I must admit that it has not been my fortune to come across a single instance of this kind of garden in Bombay, in which the choice of plants corresponds with the style. Another style, in very bad taste, where statuary, fountains, parapets and other accessories of the garden are the principal features, is fortunately very rarely met with in Bombay, though objection may in many instances be taken to the various kinds of fountains, which, on the other hand, when tastefully designed and appropriately embellished with plants, are often very effective. The lawn is now found in most gardens in Bombay, and as it is easily kept up and is delightfully green throughout the whole of the year, there are very few objects that serve better to give a charming relief to trees and plants. A few trees, a clump of shrubs, an ornamental grass, a palm or two when considerately placed, greatly add to the beauty of the lawn, and many good examples of this kind are found in Bombay gardens. A few flower-beds in the lawn are desirable, when round or oval, plain in shape, but too often the beauty of the lawn is spoiled by the too great number of flower-beds. Shrubberies are commonly separated from the roads either by a bit of lawn, which is undoubtedly the most effective, by a narrow grass border, or by a mixed border of flowering or foliage plants, edged with suitable plants. The above description refers to the commoner kinds of front garden only; besides this generally at least a small part of the compound is utilised as a garden, either planted with fruit trees, or laid out in so many different fashions, that it is impossible to give a general description of them. Flower-beds, clumps of hardy ferns or various arrangements of plants in pots and tubs, often are prominent features in those parts of the garden. It is also here the fernery will generally be found. The Bombay ferneries are a peculiarity which deserves a few words. The fact is that the climate is so congenial for the growth of ferns, that nothing more than a slight protection from the sun is generally wanted to make them succeed, though naturally an increased moisture of the atmosphere is beneficial and desirable. A simple shed constructed of rafters and roofed with a loose wove of coir matting answers all purposes, especially if the sides are covered with a light trellis-work covered with creepers. Though simple in construction, comparatively inexpensive, and cheap to maintain, such sheds can be made extremely picturesque, and their interior, when tastefully laid out, occasionally with the assistance of bits of rockery, old roots of trees, tanks or fountains, often bids fair to rival or even surpass the best conservatories at home. It is not a bad plan, as is sometimes seen, to leave the north-side of the fernery open; it greatly adds to the attractions of the garden, and is perfectly safe as long as the cold north-wind is in some way, as by a not too distant shrubbery, prevented from having direct access to the plants. It is difficult to make only a limited selection, among the great number of plants common to Bombay gardens, of those that specially deserve to be pointed out as chiefly contributing to the peculiar charms of our gardens. I shall, however, seek to draw the line so as not to tire you by the enumeration of too many botanical names. The most striking of all plants in Bombay are perhaps our magnificent creepers; it is difficult to conceive an idea of a more gorgeous mass of colour than that displayed by the Bougainvilleas, when in full bloom, and how many individual objections there may be to the particular colour of the commoner kind, nobody can seriously deny its imposing effect, and all will agree in admiring the brick-coloured variety. Not so evident on account of its shorter period of flowering, but perhaps more brilliant and graceful is the vivid orange-coloured *Bignonia venusta;* less striking but graceful and charming the Antigonon, with its masses of rose-coloured flowers. In the *Thunbergia grandiflora* and *T. laurifolia*, the handsome large pale blue flowers are beautifully set off by dense and elegant foliage. The rare white-flowered variety is specially charming. The large white-flowered Beaumontia must be seen in flower to enable anybody to conceive its great beauty. Among the many Ipomæas or Morning Glory, none are more striking than the splendid dark-blue-flowered *I. Learii*, though it is in certain respects surpassed by the rather straggling pale rose-coloured *T. Carnea*, and cannot vie in beauty with the splendid dark crimson flowered *T. Horsfalliæ*, which is still very rare in Bombay. A creeper which has flowered for the first time in Bombay this year, *Odontadenia speciosa* (wrongly called *Bignonia regalis* in Bull's catalogue), bids fair to rank next to *Bignonia venusta* in beauty. It bears large clusters of Allamanda-shaped pale salmon-coloured flowers and appears to be of a free-flowering habit. Nowhere perhaps is a greater profusion of flowers met with than in the handsome Rangoon creeper, *Quisqualis indica*, a common inhabitant of our gardens. Less effective but still attractive are the different kinds of crimson and scarlet-flowered Combretums (Poivrea), the lovely sky blue Jacquemontia, the sweet-scented May creeper (*Vallaris Heynii*), the snow-creeper (*Derris scandens*), the bridal-wreath (*Porana volubilis*), all with masses of white flowers, the well-known Stephanotis, the several passion flowers, among which the scarlet *Passiflora vitifolia* ought to be more commonly grown, the quaint but handsome mauve *Petrea volubilis*, and numerous other creepers. It must, however, be regretted that one of the commonest creepers of our jungles, the brilliant *Gloriosa superba*, is but rarely met with in gardens—a fact that may perhaps be chiefly attributed to the small attention paid to caterpillars by the *malis*, as no plant is more liable to the ravages of these formidable enemies of our gardens. Other creepers are equally effective by the grandeur or elegance of their foliage, and none more striking or common than the magnificent *Pothos aurea* with beautifully golden variegated leaves, increasing in size towards the end of the shoots, or the beautiful *Monstera deliciosa*, with its large curiously lobed and pierced leaves, none more graceful than the charming *Vitis discolor*, with the dark purple, silver-blotched leaves, or the beautiful metallic bluish-green *Selaginella lævigata*, which, however, only succeeds in perfect shelter and shade. The *Ficus stipulata*, which is a good substitute for our English ivy, though having much smaller leaves, is occasionally met with, but nothing is in fact more suitable for covering the far too often unsightly compound walls. The graceful Cane-palm, *Calamus rotang*—and the glossy-leaved apple-scented *Artabotrys odoratissima*—must also be mentioned as favourite creepers, while the elephant creeper is chiefly remarkable for its rapid growth. Among the trees in our gardens, the Gold-mohur-tree (*Poinciana regia*) has no rival as to gaudiness of its bright red flowers, and gracefulness of its dense foliage, though no tree is more ugly than this when destitute of leaves. The mango-tree, which rarely in Bombay is seen to assume that perfect shape by which it at once attracts the attention in the jungle, or along the country roads, is still very attractive by the beauty and varying colour of its leaves, in which tints of pink, violet, mauve, coppered, and all shades of green are of no rare occurrence, while the individually inconspicuous flowers when covering the tree with their masses are very effective. The *Spathodea campanulata* with its large brilliant scarlet flowers in great clusters is still too rare in Bombay gardens. The Indian Laburnum (*Cassia fistula*) with its large drooping sprays of pure yellow flowers, is a most beautiful object, far surpassing the English Laburnum in beauty. The Lagerstrœmias with their large fringed mauve, pink, or white flowers, are universally admired, but are far surpassed in gracefulness by the *Lagerstrœmia parviflora* of our hills, which I hope ere long to see commonly established in Bombay gardens. The *Sterculia urens* with its large hand-shaped leaves is not a bad substitute for our Plane-trees at home. The *Michelia champaca*, the sacred pila "Champa," is famed for its strong-scented yellow flowers, which are much used by native women for adornment of their hair, thus occasionally serving a double purpose, that of ornament and that of a powerful insecticide. The *Plumieria acuminata*, another "Champa," with its handsome strong-scented white, yellow, and often pinkish-tinted flowers, is a general favourite. A dark red-flowered, scentless kind has lately been introduced. The most striking tree of our gardens is perhaps the Lettuce-tree (*Pisonia alba*), which cannot fail to attract attention by the splendid effect of its bright yellow foliage, nowhere I believe so perfectly developed as in Bombay. The Kurranj-tree (*Pongamia glabra*) reminds us very much of our beech-trees at home, when producing its light green new foliage in the hot weather. Bombay can only boast of a few handsome specimens of the tamarind tree, which grows to so great perfection up-country. Some fine specimens of the beautiful jack tree (*Artocarpus integrifolia*), and of the bread-fruit-tree, *A. incisa*, which perhaps has no rival in beauty of foliage, are occasionally met with, as also of the wild Mangosteen (*Garcinia xanthochymus*) distinguished by its extremely handsome pyramidal growth, and the *Putranjiva Roxburghii*, to which the drooping branches covered with handsome foliage and white nuts lend a peculiar charm. Among other common trees the country-almond, *Terminalia Catappa*, with its regularly whorled branches and large handsome leaves, the silk cotton-tree with its prickly stem and branches and dark crimson flowers, the Undi, *Calophyllum inophyllum*, with its glossy foliage and handsome sweet-scented white flowers are sufficiently common to be noticed, while the beautiful scarlet-flowered *Cordia sebestana* is perhaps the most appreciated tree of all in Bombay, and the Malayan rose-apple (*Eugenia moluccana*), when its branches are loaded with bright purple flowers, is well calculated to attract attention. Of trees of more recent introduction I shall but mention a few which promise to become favourite inhabitants of our gardens. The rain tree (*Pithocolobium saman*) with its handsome glossy foliage and pink flower-clusters, vying in beauty with the indigenous "Lulei" (*Albizzia stipulata*), a tree that ought sooner or later to find a place in our gardens, the *Peltophorum ferrugineum* of perfect shape, with dense handsome foliage, and beautiful yellow flowers, succeeded by shining brown pods; *Solanum maroniense*, the potato-tree, with large prickly leaves, and handsome large, dark violet flowers changing to pale lilac; the Australian Oak (*Grevillea robusta*) with silvery grey finely cut leaves; the Star-apple (*Chrysophyllum cainito*) of graceful drooping habit, with dark green leaves, which are golden brown beneath; and the Australian Bottle-brush flower, *Callistemon speciosus*. The only representative of the order of Coniferæ, which to such a great extent assist in the adornment of our gardens at home, are two or three kinds of Araucaria, *A. Cunninghami*, *A. Cookii*, *A. Bidwillii*, and a few kinds of Thuya and Cupressus, butn either of them succeed well enough to deserve general cultivation. The allied Casuarinas are, however, common in Bombay, and are often trimmed into quaint pyramids and other ungainly shapes. The palms form a conspicuous feature in Bombay gardens. Nothing can rival the beauty of a young healthy cocoanut palm, with its graceful feathery arched leaves. The common wild date palm with its spiny greyish densely tufted leaves is frequently very effective, specially when young, and the magnificent head of large fan-shaped leaves crowning the stems of the common "Brab" or Palmyra Palm is very picturesque. The fish-tail-palm, *Caryota urens,* is at once graceful, peculiar, and highly ornamental. Its long drooping clusters of flowers and fruits, originating from the stem, are a feature that strikes all strangers with wonder and surprise. The betel-nut palm has often been called the most graceful of palms, and is when loaded with its bright scarlet fruits, in truth, a striking object. The *Oreodoxa regia,* the *Ptychosperma Cunninghamiana,* (*Seaforthia elegans*), the oil-palm (*Elais guineensis*), *Livistona sinensis, L. australis, Washingtonia filifera, Cocos plumosa, Phœnix rupicola, Hyophorbe Verschaffeltii,* and other palms occasionally met with are all very graceful and desirable objects in Bombay gardens, but none of them surpass in grandeur of foliage or magnificence of flowering the Talipot palm (*Corypha umbraculifera*), which, however, unfortunately is very rare in Bombay gardens. Though not belonging to the natural order of palms, Cycas, commonly called sago-palms, must be mentioned here as very common in Bombay gardens, and nothing may perhaps be compared to the beauty of the light green feathery, gracefully arching crown of new leaves, contrasting beautifully with the spreading and recurved dark green leaves of the *Cycas circinalis,* though the much smaller *C. revoluta* is not without effect. The screw-palms (Pandanus) form other most picturesque objects of our gardens, while the allied but very differently shaped *Carludovica palmata* is a frequent ornament. The Travellers' Palm (*Ravenala madagascarensis*) with its peculiar flattened crown of plantain-like leaves is perhaps one of the most characteristic of tropical plants. Though I am conscious of a great many omissions among characteristic trees, some of which, however, are intended, because those particular trees grow to far greater perfection elsewhere in India, it will be still more difficult to point out the most characteristic shrubs, without omitting a great many. Among these none are, or at least were, more common than Codiæums or Crotons, the beauty and often curious shape of whose brilliantly-coloured foliage needs no comment; while it is well known, that they succeed admirably here; and that more than a hundred varieties are found in our gardens. They are, however, now-a-days partly giving way to quicker growing and, in certain respects, more effective shrubs, as the brilliantly coloured Acalyphas, the leaves of which vary in colour from the most brilliant metallic blood-red to the purest yellowish green, while their shape and size offer great variety, and one kind is distinguished by its long drooping blood-red flower spikes. Among the Eranthemums we have similar variations—golden greyish, violet, pinkish flaked and dark-purple narrow or broad, metallic shining leaves, while the many varieties of Graptophyllums, with broadly light or dark blotched leaves, are valuable additions to the great number of variegated shrubs, among which perhaps few are more useful, though less striking in colour, than the white-blotched *Aralia Guilfoylei*, or none more elegant and graceful than the finely feather-leaved *Panax Victoria*, or the snow shrub, *Phyllanthus nivosus*, which form a beautiful contrast to its dark purple coloured congener, *Phyllanthus atropurpureus*, the effect of which is, however, far surpassed by its ally, *Exoccaria bicolor*. Among flowering shrubs none are more effective than the brilliantly-coloured Poinsettias, of which several varieties occur, while for variety of colour, size, and beauty of the individual flowers, the numerous varieties of shoe flowers (Hibiscus) have no rivals. The Cæsalpinias (*Poinciana pulcherrima*) are most of the year covered with their large clusters of brilliant orange or pure yellow flowers, and the charm of our pure white flowered or pale-lilac Durantas can hardly be rivalled, while the masses of gigantic bell-shaped white flowers of *Datura suaveolens* are well worth admiration. The coral-stalked flowers of Jatrophas, the yellow-flowered Allamandas, *Tecoma stans* and *Thevetia neriifolia* and the scarlet *Tecoma capensis*, the snowy-white *Tabernæ-montanas*, and the almond-scented Gardenia (*G. lucida*) are along with the well-known crimson, pink or white Oleanders frequent inhabitants of our gardens, and assist with a great number of other flowering shrubs, among which perhaps the different kinds of the very popular jessamines, the brilliantly coloured Ixoras, the white-bracted Mussændas, and numerous kinds of Clerodendrons deserve to be mentioned, in yielding a continual supply of choice flowers. Among foliage plants other than palms the many varieties of Alocasias with their gigantic leaves are perhaps the most effective, but a pleasing variety is afforded by the many often brilliantly-coloured Dracænas, by the curiously blotched Dieffenbachias, by the picturesque and handsome flowered Heliconias, Alpinias, Hedychiums, and Cannas, of which at present most magnificently-flowered varieties may be met with in Bombay. Among the very great number of other foliage plants, several hardy varieties of Caladiums, with brilliantly blotched and dotted leaves, the well-known Coleus, and the splendid varieties of *Amrantus tricolor* and *A. sanguineus* deserve to be mentioned as very effective. Cactaceous plants are rare in Bombay. Among those found the wonderfully large white flowers of *Cereus triangularis* are worth sitting up for at night, the only time they expand. Some Cactus-like Euphorbias, several Agaves, Yuccas, and similar plants are fairly common. The selection of herbaceous plants in the open ground is more restricted and almost limited to bulbous and tuberous plants, among which the Eucharis, Crinum, Pancratiums, Hymenocallis, seem perfectly at home in Bombay, and the splendid varieties of Hippeastrums are gradually associating themselves to the fire-coloured *H. equestre,* an old favourite of Bombay gardens. The beautiful white or pink Zephyranthes remind us by the shape of their flowers of our homely Crocus. Single Dahlias and Chrysanthemums are friends from home, which are gradually improving and gaining ground in Bombay, while Achimenes succeed fairly well, and nothing is more graceful perhaps than the scarlet-flowered Rusellias. Of ornamental grasses a few are very effective, as the white-variegated *Arundo versicolor,* while the ordinary *Arundo Donax,* when allowed sufficient room, is very picturesque, especially when in flower, the Moonj-grasses (*Saccharum Sara*) is not a bad substitute for the Pampas-grass, and the striking foliage and graceful flower spikes of *Thysanolæna acarifera* are very attractive. For table-decorations nothing can be more useful than the copper-coloured graceful flower spikes of the lately introduced *Tricholæna rosea. Panicum sulcatum* and *P. plicatum* are effective plants, when grown in masses, and *Oplismenus imbicilis, fol. var.* (*Panicum variegatum*), with white and pinkish tinted leaves, a most useful and common plant for covering bare ground. Bamboos are not very common in Bombay, and succeed perhaps better elsewhere. Perhaps nothing adds more to the peculiar beauty of the Bombay gardens than the luxuriance which several hardy ferns display in open ground, often even when fully exposed to the sun. Of those the different kinds of Nephrolepis are the most graceful, while the light-coloured *Polypodium iriiodes,* and the dark glossy *P. phymatodes* are very effective, each in their peculiar way. The flower-beds are generally adorned with annuals, among which Zinnias, Balsams, the small-flowered sunflower (*Helinthus cucumerifolius*), Galliardias, Coriopsis and Coxcombs may be met with at different seasons of the year, but arrive to the greatest perfection during the rains. In the cold weather our flower-beds can be kept more gay by annuals, such as Phlox, Poppies, Nasturtiums, Chinese Pinks, Portulaccas, Pansies, Verbenas, China Aster, Petunias, &c., which often under favourable circumstances succeed admirably. In many cases it is a surprise and disappointment to new comers to India to see our flower-beds embellished with plants familiar to us from home ; and in truth it is to be regretted that so very few plants of less ordinary character have found their way to our gardens, and as a step in the right direction it must be appreciated that such plants as the Zanzibar balsam, *Impatiens Sultani,* with its beautiful crimson flowers, and the Neilgherry violet, *Torenia Fournieri,* to which a yellow-flowered kind, *T. Bailloni,* has now been also added, and a white-flowered variety (White Wings) may be expected to flower in this cold season, are rapidly gaining ground in our gardens. Edging plants are rather an important feature of Bombay gardens, and the old-fashioned *Justicia gendarussa* is now almost everywhere replaced by other plants, such as the moss, like *Pilea muscosa,* the neat dwarf coleus, which when covered with its beautiful sky-blue flowers is very attractive, the Australian daisy (*Vittadenia australis*), the bright green stone crop (*Sedum sarmentosum*), the hairy crimson-flowered Purslane (*Portulacca pilosa*), the dark olive green, and in Bombay rarely variegated Alternantheras, the dark purple *Aerusa sanguinolenta,* the metallic grey and purplish *Hemigraphis colorata,* the silvery *Tradescantia zebrina,* and several others. I have now, I believe, mentioned the most important and peculiar plants grown in Bombay gardens, but I am afraid I have already tried your patience too long, and shall therefore leave another important feature—a peep into the Bombay ferneries—to a future occasion. I may, however, add that the Committee of our Society intend if feasible to publish in the Journal a series of illustrations of Bombay flowers, an undertaking that, when carried out, without doubt will further increase the popularity and high standard of the Journal.

The Hon. Mr. Justice Birdwood referred to the difficulty of rearing the seed of the *Gloriosa superba* in Bombay, and pointed out that when they were sown under oleander bushes they appeared to be protected against the attack of the caterpillars, which usually destroyed them.

A vote of thanks to the lecturer was then passed, and the Meeting ended.

MISCELLANEOUS NOTES.

I.—TIGRESS'S MILK AS A MEDICINE.

THIS medicinal preparation is believed to be of an efficacy proportionate to the difficulty of obtaining it. I have twice heard its praises. Once a Hospital Assistant asked me to get some, as it was very efficacious for sore-eyes. I asked how it was usually obtained. He said that when the tigress was suckling her cubs, some of the milk fell on a stone, and was afterwards collected by the watchful jungle-wallah. Again I was told by a man, that if I could get some tigress's milk it would save the life of his child, who was suffering from shortness of breath! He gave me the same account of the way of collecting it.

H. LITTLEDALE.

Baroda, September, 1890.

II.—THE BENGAL WATER COCK, *(GALLICREX CRISTATUS)* FIRST OBSERVED IN GUZERAT.

I HAVE to record, for the first time, the occurrence of the Bengal Water Cock *(Gallicrex cristatus)* in Guzerat, as a female was shot on 25th September by Lieut. Percy Bell, 5th Bombay Light Infantry, in my presence, on a small tank amid rice fields, at Harni, four miles north of Baroda. It measured in the flesh:—Bill from gape, 1·25; tail, 2·45; wing, 6·95; length 13·8; tarsus 2·5; expanse 22. The colours of the fleshy parts were as described by Jerdon, Barnes and Murray, with the exception that no red was visible at the base of the bill, which was a dull yellow. The bird was probably young, of last year's brood. The Bengal Water Cock has never before been recorded from this Presidency, except from Sind; in ten years shooting it is the first I have noticed.

Baroda, September, 1890. H. LITTLEDALE.

III.—PROPOSED INTRODUCTION OF THE BLACK PARTRIDGE AND OTHER GAME INTO THE NEIGHBOURHOOD OF BOMBAY.

I BEG to suggest that an attempt should be made to introduce the Chukor into this part of India. Such an effort would certainly succeed on the Aravellis and Vindhyas, along the big rivers. Again, the Painted Partridge is our only Southern-Bombay bird ; the Black Partridge, a far finer bird, ought to take advantage of the R.-M. Railway and settle in our grass *birs*. He flourishes on the hot grassy plains of Rajputana, amid the tamarisks of the Indus, and along the banks of the Jhelum in Kashmir ; any climate seems to suit him, wet or dry.

The Chukor stretches across Asia, Africa and Europe, from the Chenab to the Rhone ; I have found its nest, at 11,000 feet, in Baltistan, and it ranges through the low hot levels of Mekran and Arabia. It is a very *gamey* bird, and, if a fair chance were given it, it would certainly thrive on our Ghâts everywhere.

The Bengal Florican also might be tried. Game is said to be getting scarcer. Shikaries should try to introduce new blood.

Again the Markhor might flourish on the Nilgiris ; it lives at 7 to 9 thousand feet in the rainy Pir Panjal, and the Nilgiri climate would suit it perfectly. There are several African animals, antelopes and so forth, that would thrive in India, and might be easily introduced.

Let our Sectional Committees take this suggestion up, if they think it worth acting on. Money would certainly be forthcoming for a well-considered scheme of introducing to the Bombay side animals that would probably thrive there, and give good sport to future generations of sportsmen. I look to this, rather than to vexatious Game laws, to provide such shikar in the future as has been enjoyed in the past.

H. LITTLEDALE.

Baroda, September, 1890.

IV.—PERIODICAL FLOWERING OF *STROBILANTHES*, SPP., AND OF *ÆCHMANTHERA TOMENTOSA*, NEES.

It has been observed that certain species of *Strobilanthes* become periodically conspicuous by the abundant production of flowers during particular years. As a notable example, *Strobilanthes callosus*, Nees, may be mentioned. This is a shrubby species common on the Western Ghâts, also on Mount Abu in Rajputana, where it thickly covers some of the higher slopes on the western side of the range. The profuse flowering of this species is said to take place here about every 8 or 9 years, and I was fortunate in finding it in this condition when visiting Abu in 1887. It also occurs in the Nimar district on the range of hills between the Nerbudda and the Tapti valleys, where I found specimens in 1888, which had not flowered in that year. The natives there call it *Kara*, and they say that it flowers every three years. The same plant is called *Karvi* in Thana, and it is mentioned in the *Gazetteer* of that district as flowering after periods of eight years, and that the blossoms exude a quantity of viscid juice called *Mel*, which appears to be very attractive to cattle. In Nasik this plant flowered abundantly in 1880.

A few years ago the Forest Officer in Jaunsar drew attention to the abundant blossoming of another species of *Strobilanthes*, which forms a large portion of the undergrowth in the forests above Chakrata.

During a tour I made in N.-E. Kumaon in 1886, the flowering of *Strobilanthes Wallichii*, Nees, was remarked as constituting a very striking feature of the scenery up to about 11,000 ft. The hillsides for miles round about Budhi village, in the Kali Valley, as well as in the Dhauli Valley of Darma, were tinged with a delicate lilac colour, resembling that of heather at a distance. This particular tint was the blend of every shade of purple mixed with pure white.[*] The flowers have a strong scent of musk, and are very sticky, with glandular hairs.

During the present year, *Æchmanthera tomentosa*, Nees, another Acanthaceous plant, and closely allied to *Strobilanthes*, has been making itself floriferously conspicuous on the rocky slopes below Mussoorie. Its rich purple flowers and silvery pubescent foliage produce a beautiful effect as seen in masses. In regard to the above-mentioned examples, the gregarious habit of growth is a great aid towards observing occurrences of those periodical bursts of blossoming. The final reproductive effort exhibited by some kinds of the bamboo, after a certain period of flowerless condition, frequently results in the death of all the individual plants of a species, even of those which developed no flowers. The species of *Strobilanthes* and *Æchmanthera* mentioned above do not, however, appear to be affected in this way.

J. F. DUTHIE.

DEHRA, *4th October*, 1890.

V.—MARKHOR SHOOTING IN EAST AFGHANISTAN.

MR. JOHN E. PENTON, District Superintendent of Police, Jacobabad, writes as follows:—

"I have just returned from East Afghanistan, where I have been shooting Markhor—the straight-horned variety—whose habitat Kinloch gives as *Yusufzaie, the Khaibar, and other parts of Northern Afghanistan*; and, as I fancy there is not much on record about this particular variety, I will venture to give you what little experience I have gained of its habits, size, &c.

The Markhor found in Afghanistan is an exceedingly fine animal, an old male will measure from 36 to 40 inches or more at the shoulder. The largest animal shot by myself measured when dead on the ground exactly 36 inches. This however was, I should say, considerably under his real height, as after death the muscles relax. The length of the body, from rump to chest, was 42½ inches. Horns only 27 inches long, but nearly 12 inches in circumference at the base. My Pathan shikaree calculated the age of the beast by the number of dark rings on the horns. He made it out to be eight years old, and there is no reason to doubt his statement, as I have never found this method lead to extravagant results. The longest Markhor horns which I have ever come across in Afghanistan, I do not think would have measured more than 36 inches, and as a rule the very long horns are not so massive as those of medium size. The pair in my possession are about as massive as any I have ever seen.

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[*] This species is found also in China, and the flowers are said to vary there from white to pale blue and purple. (Forbes and Nemsley, *Index Floræ Sinensis*, in *Journ. Linn. Soc.*, xxvi., 242.)

There are two kinds of Markhor in Afghanistan, one with horns diverging considerably at the points, and the other with horns not more than 17 or 18 inches across from tip to tip. The former is called by the Pathans "Nussel," and the latter "Assel." Those horns which diverge a great deal are longer, but not so massive as the others.

The general colour of an old male is a dirty iron grey. His beard is long and flowing, and much darker than the rest of his body. In summer his coat is short, but long in winter. From April to November there is a reddish tinge about it, while during the remaining months it loses this and becomes more grizzly. The females are less than half the size of the males, and are of a dark fawn colour. Sterndale states that they have a short, black beard. I myself have never seen one with anything more than the merest rudiments of a beard, while many have absolutely no signs of it. They have short twisted horns about 8 to 10 inches long.

The Markhor frequent the loftiest and most precipitous mountains of Afghanistan, the chief ranges in British territory being Zargungar, terminating north-west in the peak of Tākătoo, and what one may call the Kāliphăt range, terminating east, in the mountains of Shám, overlooking the Bori valley. Zargungar rises to an elevation of 11,700 feet, and Sham to about 11,200.

Owing to the difficult nature of the ground, and the extreme wariness of the old males, Markhor shooting in Afghanistan is, I believe, the most trying sport one can possibly undertake. The best months are November, December and January, for at this season the males mix with the females, and are consequently much easier to find than at any other time of the year. The largest Markhor that I bagged, was shot in the following manner, which will give you a fair idea of what this kind of sport really is:—For nearly six weeks I lived out on the hills with nothing but my rifle and a blanket, accompanied by three Pathans, and although I worked exceedingly hard the whole time, I never was fortunate enough to secure a really good head. I had shot in all seven Markhors, but the heads were small, and I was not altogether satisfied. Finally I resolved to return to my fixed camp and take a rest, as all of us were more or less knocked up. While actually marching back to our head-quarters, my shikaree espied a magnificent old Markhor lying in a hole in the rocks immediately above us, and about 500 yards off. A council of war was at once held, but the matter appeared to be utterly hopeless, as the ground seemed to be absolutely impossible. The hole which the Markhor had chosen was actually on the face of a precipice. However, I determined to try it, and accordingly started off with the shikaree, leaving a man below to watch the Markhor. The wind was fortunately in our favor, and we commenced the climb. How I managed to get within 50 yards of the hole I never quite knew, but I did somehow, and having seated myself on a ledge, about 18 inches broad, I sent the shikaree round to drive the Markhor from his position. This was an exceedingly difficult job, and the animal when disturbed would, I felt sure, disappear up a chasm, situated just above the hole, without giving me the chance of a shot. After a very difficult climb my shikaree cleverly managed to get above the Markhor and commenced throwing stones into the hole. At first the wary old goat refused to move, but eventually he changed his mind, and came thundering down in my direction. I heard him coming, but I could not see him; when suddenly he sprang on to a projecting rock just above me, and as he did so, I covered him with my rifle and pressed the trigger. There was a crash of falling rocks, and the rushing sound of a heavy body falling through space. The smoke was cleft aside, and I just caught a glimpse of the Markhor as he passed hardly five feet from me a lifeless mass. Some seconds after there was a dull thud far away down at the bottom of the precipice. Success at last. In a moment I had forgotten all we had gone through, and, calling to my shikaree to follow, I proceeded to descend the face of the precipice. I found the markhor lying dead in a dry water course with hardly an unbroken bone in his body, but, strange to say, neither his skin nor his horns were very much damaged, though he must have fallen nearly 400 feet. He was a magnificent sight as he lay on the rocks before me: a prize which any sportsman might well be proud of. My shikaree and myself could only just manage to lift him off the ground, so that he must have weighed at least 200 lbs."

VI.—PARASITIC FLIES.

In the month of July last, I noticed a large moth caterpillar motionless in the middle of a leaf, and two large flies with red heads standing close by. The flies had a felonious look which I thought I recognised, so I put them under surveillance. Presently one of them advanced slowly towards the caterpillar and walked cautiously along the fringe of long hairs which protected its sides. Suddenly it stopped, and going as near as the hairs would allow, till its head almost pressed against them, curved its abdomen under it and extended an ovipositor nearly half an inch in length. Passing this carefully between the tufts of hair it deposited an egg (I take this for granted), and then, with extreme caution, backed a few paces. This operation was repeated several times on one side, and then the fly went to the other, making a wide detour round the caterpillar's head. This scene suggests some curious reflections. I have long believed that the mimicries and other protective devices so common among caterpillars are not designed for protection against birds so much as against their arch enemy, the parasite, dipterous or hymenopterous, but it never struck me before that the lateral fringe of spines, bristles or hair, which we find in *Euthalia* among butterflies, and in many genera among moths, was meant to guard the soft underparts, to which apparently the egg must be attached. If this be so, then we must suppose that a keen evolutionary race is going on now between the growth of the larva's hair and the parasite's ovipositor. They were pretty evenly matched in the instance I have quoted, and the fly had no easy task, which may account for what at first puzzled me, the cat-like caution of the fly. The caterpillar could not hurt it, but might, if alarmed, have frustrated its purpose, either by erecting the tufts of hair, or simply by moving.

E. H. AITKEN.

Karwar, November, 1890.

VII.—DISSEMINATION OF LARVÆ.

SOME time ago I got a large pupa, and throwing it into a cage of gauze, forgot it. One morning my attention was attracted by a cloud of small moths fluttering round the cage, and on looking in I found that a great apterous female moth had emerged from my pupa. I let in one or two of the males and the rest very soon dispersed. Next day the female produced almost her own weight of eggs, and then, shrivelling up like "*She*" after her second immersion in the flame of life, died. In a few days a swarm of caterpillars appeared clothed with hair so long that the wind blew them about as easily as the seeds of a thistle. They did not, however, trust themselves altogether to the mercy of the wind, but, attached very fine lines of silk to the cage, on which they floated away like gossamer spiders, or to use a more homely simile, paper kites. The silk readily caught the posts of the verandah, or branches of trees, and so, in a short time, there was a network of fine lines, extending eight or ten yards to leeward, with caterpillars crawling along them in all directions, or letting themselves be blown from one to another. The resemblance of the whole thing to the dispersion of plumed seeds was very striking, and in view of the fact that many moths make no attempt to seek their food plant, but lay their eggs just where they chance to be, the incident suggests an interesting subject for investigation.

E. H. AITKEN.

Karwar, November, 1890.

VIII.—RED ANTS' NESTS.

Some time ago I gave the members of the Society some account of the ways of the red ant (or yellow ant, as some prefer to call it,) known to formicologists as *Œcopylla smaragdina.* I did not then know how it constructs its curious leaf nests, so bitterly familiar to many of us. How I could live so long without knowing this, I cannot now explain, but in case there are others as stupid as myself I will describe the process. I first saw it going on in a tree with very large, leathery leaves, two of which were then being drawn together. Beginning at the point where the leaves were nearest each other, several ants laid hold of one with their jaws, and of the other with their hind feet, and began to pull as ants can. Further on, where the distance was greater, one ant seized one leaf with its jaws, then a second seized the first by the "small of the back," grasped the other leaf with its hind feet, and pulled. Further on still a chain of three, four, five, or even six, ants united the two leaves. As every member of the community which could find room for jaw or foot joined in, the space between the leaves was spanned by a web of ant fabric, in a state of the highest tension, very like the elastic in a "springside" boot. In the meantime a number of single ants were busy securing the labours of the rest with strong cords of silk, and tightening these as the leaves were drawn nearer and nearer. When a sufficient number of leaves have thus been bound together at their edges, the whole is made weatherproof with sheet silk, and divided into chambers and passages with the same material.

E. H. AITKEN.

Karwar, 3rd November, 1890.

IX.—A "MALABAR CROW PHEASANT" TAKING TO THE WATER.

On Saturday evening last, November 15, I was playing with my children by the Charlotte Lake at Matheran, when our tonjon-wallas called my attention to a creature which was slowly and awkwardly swimming towards the opposite bank. Two or three kites were wheeling above it; but whether they had driven it into the water, or were only minded to take advantage of its difficulties, I do not know. Our shouts drove them away, and the swimmer reached the bank at a shelving place, and we recognised it as a "Malabar Crow Pheasant." It disappeared among the brushwood for perhaps a quarter of an hour or twenty minutes, and then, with no kites or other visible danger in sight, we were astonished by seeing it take to the water again, and swim for the bank from which it had started. As it was making for a place where the edge is a sheer wall, we went along to meet it. It swam straight for us, and only turned off at a right angle, skirting the wall, when it was well within arm's length. Then, as it seemed exhausted, I reached out and lifted it from the water. I was able to observe it carefully for the last few yards of its curious swim. The whole body was submerged, and only the head and neck, and the extreme top of the pinions stood out of the water. It oared itself along with its wings, bringing them forward and striking back with them. The legs seemed to trail quite motionless. It was too exhausted to struggle at first, and when it tried to flap away, could neither raise itself from the ground nor even hop, without tumbling over constantly. Seeing it so helpless, we took it home in our tiffin-basket and gave it food. Next morning, on being given its liberty, it flew away. It seemed a very young bird, though fully-fledged. The incident of a land-bird taking to the water twice, the second time with no apparent compulsion, seemed to me curious enough to be worth communicating.

L. P. BOMBAY.

Bombay, November 21*st*, 1890.

X.—BEES DESTROYED BY *LAPINDUS EMARGINATUS*.

I am sending you a box of dead bees[*] I picked up under a tree now in flower in the gardens, *Lapindus emarginatus*. The tree begins to flower about the middle of October, and bears a profusion of small whitish inodorous blossoms which attract the bees. It seems very strange that insects possessing such a wonderful instinct should drink the nectar from the flower and get killed in this way, for I found them dead in thousands under the tree. The effect produced appears to be that of a powerful purgative, and there are now numbers of bees buzzing about on the ground unable to fly.

THOS. H. STOREY.

Oodeypore, December, 1890.

PROCEEDINGS.

PROCEEDINGS OF THE SEPTEMBER MEETING.

The usual Monthly Meeting of the Members of this Society took place at their rooms in Apollo Street on Tuesday, the 23rd September, and was largely attended. Dr. Maconachie presiding.

The following new Members were elected as from the 1st of October:—Mr. J. B. Fuller, C.S. (Nagpore), Mr. C. S. Spalding (Bhownugger), Mr. D. Knight, Mr. John E. Penton (Jacobabad), and Monsieur H. Levellé (Pondicherry).

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions:—

CONTRIBUTIONS DURING AUGUST AND SEPTEMBER.

Contributions.	Descriptions.	Contributors.
1 Toddy Cat (alive)	Paradoxurus musanga	Mr. N. M. Patel.
2 Snakes (alive)...............	Tropidonotus stolatus and Zamenis fasciolatus.	Mr. J. Mason.
1 Indian Monitor (alive)...	Varanus bengalensis	Mr. G. de Saone.
1 Collection of Butterflies..	....	Mr. W. George.
1 Green Dove	From Alibag.	Mr. W. F. Sinclair, C.S.
2 Sheer Waters, a quantity of fish & marine animals.		

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[*] *Apis indica.*—Editor.

Contributions.	Descriptions.	Contributors.
1 Tailor Bird's Nest	Orthotomus sutorius	Maj. W. P. Kennedy.
1 Squirrel (alive)	From Zanzibar	Mr. X. Castelli.
1 Snake (alive)	Aspidura trachyprocta	Mr. O. Meyer.
6 Eggs of Large Sea Tern...	Sternia bergil	Lieut. H. E. Barnes.
6 Eggs of Lesser Sea Tern.	Sternia media	Do.
1 Cobra (alive)	Naga tripudians	Mr. W. Ballantyne.
1 Black Rock Scorpion (alive).	With young	Mr. Jas. Dickson.
1 Otter's Skull	Lutra vulgaris	Mr. J. F. Snuggs.
A number of Fishes, Insects and Reptiles.	From Raipur, C. P............	Mr. J. A. Betham.
1 Panther (alive)	Felis pardus	Mr. W. Souter.
18 Snakes	From Travancore	Trevandrum Museum.
2 Dolphins' Heads	Neomeris karachiensis	Mr. W. F. Sinclair, C.S.
1 Snake	Chrysopelea ornata...........	Dr. Harold Brown.
1 Bear's Skin	Ursus arctos	Purchased.
1 Do.	Ursus torquatus	Do.

Minor contributions from Mr. Thos. Rogers, Major C. R. Sage, Mr. J. Janni, Mr. A. C. Walker, Mr. N. Purbhoodas, Mr. J. Counsell, Mr. H. M. Waller, Mrs. Meyer, and Surg.-Major Webb.

The Honorary Secretary stated that the panther received from Mr. W. Souter had been placed in one of the new open-air cages at the Victoria Gardens. He also drew attention to the fact that contributions of cheetal or spotted deer would be most acceptable.

CONTRIBUTIONS TO THE LIBRARY.

The following journals were received in exchange :—Journal of the Elisha Mitchell Scientific Society, July—December, 1889; Bulletin of the American Museum of Natural History, December, 1889, to February, 1890; Proceedings of the California Academy of Sciences, Vol. II. ; Journal of the Asiatic Society of Bengal, No. 1 of 1890; Oriental Cicadidæ (Distant), Part III. ; Journal of Comparative Medicine and Veterinary Archives; and Records of the Geological Survey of India, Part III.

VOTE OF THANKS.

A vote of thanks was passed to Mr. T. B. Fry, of Poona, for the valuable collection of about 1,800 specimens of dipterous insects which he had made for the Society, and which had been sent to England for classification.

A PANTHER CHASING A NILGHAI.

The Honorary Secretary read a note from Mr. J. M. Coode, Nagpore, C.P., in which he described having witnessed a panther chasing a nilghai for a long distance. It was resolved to publish the note in full in the next number of the Society's Journal, as the occurrence seems to have been an unusual one.

PROTECTIVE COLOURING OF CHRYSALISES.

An interesting paper was also read from Mr. A. W. Morris, of Bangalore, containing an account of some remarkable results of his experiments with the larvæ of various butterflies, showing that the chrysalis can be made to adopt almost any colour by artificial means.

THE SOCIETY'S JOURNAL.

The Honorary Secretary mentioned that No. 3 of the Society's Journal was now being printed, and would contain 114 pages and seven illustrations, five of which were coloured plates produced in England. Those present were also reminded that if any of their friends wished to become members they would gain a considerable advantage by joining the Society at this time of the year, as, under Rule No. IV., the subscription of those elected during the months of October, November, and December would extend to the 31st of December, 1891.

THE FERNS OF NORTH KANARA.

A list of 75 species of Ferns collected by Major T. R. M. Macpherson, of Poona, in the district of North Kanara, was laid upon the table.

BOMBAY GRASSES.

The second part of Dr. J. C. Lisboa's paper on the Grasses found in the Presidency was read, and the thanks of the Meeting were accorded to the author.

THE PHYSICAL GEOGRAPHY OF THE NEIGHBOURHOOD OF BOMBAY.

Mr. W. F. Sinclair, C.S., Collector of Alibag, then read a paper on the above subject, especially referring to the paper by Mr. W. E. Hart on "Prehistoric Bombay," which appeared in the last number of the Society's Journal.

Dr. G. A. Maconachie proposed a vote of thanks to the lecturer for his interesting paper, and the Meeting then terminated.

PROCEEDINGS OF THE DECEMBER MEETING.

A Meeting of the Members of the above Society was held on Wednesday, the 3rd December, when Dr. D. MacDonald presided.

ELECTION OF MEMBERS.

The following gentlemen were duly elected members of the Society :—

His Highness Thaktsingji, the Thakore Saheb of Bhownugger, Mr. Ernest Proctor Sims (Bhownugger), Mr. Charles G. Rogers (Dehra Dun), Mr. F. Lang (Nagpore), Mr. Charles W. M. Hudson, C.S. (Kanara), Major G. C. Dobbs (Kamptee), Dr. J. S. Green (Kamptee), Mr. E. C. Ozanne, C.S. (Poona), Mr. J. B. Alcock, C.S. (Dhoolia), Mr. R. S. F. Fagan (Khandeish), Mr. G. O. W. Dunn (Malegaon), Mr. J. S. Gamble, (Dehra Dun), Dr. A. Lingard (Poona), Mr. W. R. Woodrow (Kanara), Mr. S. M. Fraser, C.S. (Dharwar), Dr. S. E. Prall (Deesa), Mr. H. C. Syers (Selangor), Dr. J. L. Welch (Selangor), Mr. A. J. Hogg (Hubli), Mr. F. D. Fowler (Bombay), Mr. F. J. Preston (Akola), Mr. Norman C. Macleod (Bombay), Mr. Edwin W. Yeo (Bombay), Major P. L. Clowes, A.D.C. (Poona), Mr. C. R. Hawkins (Bombay), Mr. E. M. Pratt, C.S. (Kolaba), Mr. Thomas Rogers (Bombay), Mr. John Stiven (Bombay), Mr. Harry Davies, C.E. (Ghadechi), Mr. H. C. Burder (Bombay), Mr. W. G. Mayhew (Bombay), Mr. P. R. Savile (Bombay), Mr. A. Tomlinson, C.E. (Bombay), Mr. George G. E Plinston (Bombay), Mr. H. H. Deane, C.E. (Bombay), Mr. J. Leask (Bombay), Rev. Dr. B. de Monte (Bombay), Mr. E. Greenwood (Bombay), and Dr. J. F. Gonsalves (Bandora).

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions :—

CONTRIBUTIONS DURING OCTOBER AND NOVEMBER.

Contributions.	Description.	Contributor.
A number of Insects, Birds, Eggs and Nests	From Kumaon	Mr. H. M. Hewitt.
1 Snake	Tropidonotus quincunctiatus.	Mr. W. Murray.
1 Sloth Bear	Melutsusursinus	Major Radcliffe.
1 Snake (alive)	Echis carinata	Mr. W. C. Leckie.
1 Spotted Deer (alive)	Axis maculatus...	Col. MacDougall
1 Snake	Hypsirhina enhydris	Mr. E. Y. Watson.
1 Wolf's Skull	Canis pallipes	Col. Szezespauki.
1 Cheetah's Skull	Cynælurus jubatus	Do.
1 Krait	Bungarus arcuatus	Mr. E. A. Corke.
A number of Crabs and Lobsters	From the Andamans	Mr. W. G. Wyndham.
1 Snake	Onycholephalus acutus	Mr. E. L. Cappel, C.S.
1 Sea Snake (alive)	Hydrophis chloris	Miss E. Killen.
5 Monkey's Skulls	From Ceylon	Mr. R. Wardrop.
2 Eggs of Fishing Eagle	From Rutnagherry	Mr. E. A. Bulkley.
3 Snakes	Simotes russellii, Lycodon aulicus, and Trop quincunutiatus.	Mr. C. E. Kane.
1 Large Centipede alive	Scolopendra gigantea	Mr. R Mactier.
1 Snake	Dipsas gokool	Mr. G. de Soane.
1 Snake	Dendrophis picta	Mr. H. E. M. James, C.S.
2 Snakes	Callophis trimaculatus and Trimeresurus strigatus ...	Capt. the Hon. St. Leger Jervis, A.D.C.
1 Snake	Passerita myclerizans	Major Clowes, A.D.C.
15 Snakes (comprising 7 Species)	Echis carinata	Dr. H. P. Dimmock.
	Oligodon fasciatus	
	Dipsas gokool	
	Cynophis malabaricus ...	
	Tropidonotus plumbicolor ...	
	Oligodon subgriseus	
	Lycodon aulicus	
1 Wolf's Skull	Canis pallipes	Mr. J. F. Snuggs.
1 Fox's Skull	Vulpes bengalensis	Do.
1 Water Hen (alive)	Gallinula chloropus	Mr. D. M. Doboe.
1 Snake	Zamenis diadema	Mr. B. W. Blood.
15 Young Turtles alive ...	Chelonia virgata	Mr. W. F. Sinclair, C.S.
1 Cobra (alive)	Naga tripudians	Mr. Jehangeer H. Mody.
1 Civet Cat (alive)	Viverra malaccensis	Dr. B. deMonte.
1 Burmese Krait (alive) ...	Bungarus fasciatus	Dr. E. Harold Brown.
2 Snakes	Bungarus arcuatus & Zamenis fasciolatus.	Mr. C. E. Kane.
A number of Land Shells	From Jubbulpore	Mr. William Shipp.
1 Snake	Passerita mycterizans	M. J. Janni

Minor contributions FROM Mr. Tribhuvandas Mangaldas Nathubhai, Dr. de Monte, Mr. C. M. Sykes, Mr. J. M. Betham, Mr. H. M. Waller, Capt. Boswell, Mr. A. E. Walker, Miss Gostling, Mr. Hargrave, Capt. Thorburn, Mr. B. A. Gupte, Mr. E. Smetham, Miss Killen, Mr. J. M. Coode, Mr. J. Counsell, Mr. E. Wimbridge, Mr. A. C. Parmenides, and MajorMacpherson.

A short note from the Bishop of Bombay was read, containing an account of a Crow Pheasant swimming across the Charlotte Lake at Matheran. It was decided that the note should be printed in the Journal.

Mr. G. Carstensen, the Superintendent of the Victoria Gardens, then read a paper on Bombay Gardens, which appears on page 397 of this Number.

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